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THE PRAIRIE POCKET GOPHER, THOMOMYS TALPOIDES RUFESCENS

BY STUART CRIDDLE

[*Plate 15*]

The information presented in this study of the habits of the pocket gopher, *Thomomys talpoides rufescens* Wied, relates more to the animals found within a few miles of my home at Aweme than it does to those mentioned from other districts, such as Lake Dauphin, Swan River and Snowflake; because, while all pocket gophers found in Manitoba are at present known under the above name, it is strongly suspected that three, and perhaps four, geographical races occur within the Province.

The study is largely the result of work carried on during 1927–8 and 1929. It was made possible through a grant of the National Research Council of Canada to Dr. Chas. H. O'Donoghue, former Professor of Zoology at the University of Manitoba, under whom the work was carried on during the first year, and to whose advice I am very much indebted. I am also under much obligation to Mr. Ferris Neave, who later took over responsibility for the grant. My appreciation and thanks are likewise extended to my brothers: Norman, who has given much of his spare time both in the field and in the laboratory; and to Evelyn for procuring specimens, and in other ways assisting me.

DISTRIBUTION

With the exception of a few isolated localities, such as those which are heavily timbered, swampy, or in other respects unsuitable, the pocket gopher occurs over the whole of that part of the Province west of a line

drawn from the International Boundary south and east of Winnipeg, past that city to just south of Lake Manitoba, then north to the southwest shore of Lake Dauphin and past Sifton to Ethelbert. A break of over thirty miles occurs between the latter place and Cowan because of the intervention of the Duck Mountains. From Cowan the line goes north, and then west to Swan River, and then turns from that town in a south-westerly direction to Benito and ends, so far as Manitoba is concerned, at the Inter-provincial boundary. The farthest east I found these gophers was close to Giroux, and the most northerly point was a few miles east of Swan River.

DESCRIPTION

Briefly speaking, the pocket gopher (Pl. 15), is a thick set, strongly built rodent, highly developed for burrowing. It has small eyes, short conical pointed ears, and large, fur-lined cheek pouches, that extend back to the shoulders. The feet are very strong, the fore ones, which are much the largest having very long sharp, almost knife like, cutting claws, and also stiff hairs on the outer margins of the fingers and back of the large hand pad. The hind feet besides being smaller have short, peg-like claws, and lack the stiff hairs on the fingers or toes. All are naked on the under side. The rather short and stiff tail is nearly square, and thinly covered with short coarse hair. The skin is strong, and very loose, and is covered with soft, silky, dense gray fur, which is only in prime condition from December to the middle of April. During the rest of the year the animal seems to be in a perpetual state of moult, which at times gives the fur an odd and uneven appearance, as shown in the figure.

MEASUREMENTS AND WEIGHTS

The following measurements are in millimeters, and include the total length of the animal from the tip of its nose to the end of the tail vertebrae, the right hind foot from the heel to the end of longest toe nail, and the ear from its base behind to its tip. The weights are in grammes.

Aweme.—Average of fourteen males: Total length 233.8; tail vertebrae 66.5; hind foot 26.1; ear 6.2; weight 149.72 gr. Average of thirteen females: Total length 220.3; tail vertebrae 65.5; hind foot 27.5; ear 6.2; weight 126.90 gr. Largest of fourteen males: Total length 254; tail vertebrae 72; hind foot 27.5; ear 7.5; weight 177.80 gr.

Lake Dauphin.—Largest of eight males: Total length 257; tail vertebrae 82.8; hind foot 32.3; ear 7.4; weight 208.77 gr.

Snowflake.—Largest of two males: Total length 261.7; tail vertebrae 76.2; hind foot 34.6; ear 6, 7; weight 198.29 gr.

THE POCKET GOPHER, SHOWING SPRING MOULT. JUNE 3, 1928

I have too few specimens from either Lake Dauphin or Snowflake to give anything like trustworthy averages, but four animals from the former place were heavier than the largest from Aweme. The specimens collected at Swan River were found to be immature and the measurements are not given.

DIGGING

I have often watched pocket gophers while in the act of digging, and though their movements are extremely rapid they can be readily followed. In soft soil a few half circular, downward slashes are made, first with one hand and then with the other, the animal turning slightly from side to side in the operation; the earth thus cut loose is passed under the body to the hind feet, these are brought forward together and quickly kicked backward in unison to throw the earth behind the digger. These operations continue until the loose earth begins to crowd the animal from behind. Then with its head held to the side and well down the gopher turns around; and with breast, and hands held outwards propels the load to the exit, the hind legs being used as the motive power. In this work the teeth are used for cutting all the larger roots, and occasionally for loosening hard earth or other obstructions encountered in digging.

WORK

In the spring, pocket gophers commence their burrowing operations as soon as the thawing of frosted soil allows them to do so. Work at first seems to be done more with the object of cleaning out the feed tunnels than in hunting for food. Commencing about the second week in April, there is a sudden change from the previous somewhat dilatory state to one of more vigorous activity. The change is in part due to the necessity of obtaining a supply of food for the mating season, and also to sexual advancement. This period of activity usually continues into May when the volume of work again decreases, and at certain homes stops entirely, due to the arrival of the mating season, when certain occupants have gone forth to seek mates. Such homes, in a few cases, may be permanently abandoned, but as a rule their owners return to them after a short absence.

Another period of apparent inactivity occurs at certain homes during the middle part of June; these are the habitations of females about to produce young, or with young already born. Work is soon recommenced at these homes; but from now until preparations are under way for the winter, little digging is done, because at this time of the year the animals feed to a large extent on green food.

With the approach of autumn the volume of work is slowly increased, and by the end of August it is at its maximum. From then on it is continued, excepting in localities where food plants are unusually abundant, until frost finally puts a stop to subsurface operations.

NESTS

Pocket gophers, like most of our northern rodents, provide themselves with luxurious sleeping quarters, but in their case the raw material used does not seem to matter much; because after being placed in the nest chamber in its natural condition, it is cut and shredded so finely that its fitness for a bed is no longer in question. The grass or other material used is packed into the animal's large pouches by the aid of the front feet, then carried down to the nest chamber, where the little bundles are removed from the pouches and placed in position without being torn apart. As soon as the gopher has sufficient material for the nest, it turns its attention, in a leisurely manner, to tearing and cutting it into fine shreds; and judging from the animals in captivity this work is carried on, intermittently, for weeks. That the material is occasionally moved is evident, but there is little reason to suppose that it is added to after the nest has once been finished. However one of my animals in an open cage, without a nest box, frequently changes its nest from one end of its cage to the other, and adds any suitable material, such as bits of rag, paper, feathers, dry grass, etc., that may be offered. Others with their nests in boxes will leave such material for weeks before making use of it, and then it may only be placed at the entrance. This is probably accounted for by the animal's already having sufficient in the box for its comfort.

From the number of nests examined, and from watching the captives referred to above, it appears that these rodents eat most of their food in the nest, and it is rarely that a nest is found which does not contain some food in it or near its entrance.

During the summer months enough food is taken to the nest for the day's requirements, while during the winter it is brought from one of the stores. That this is so, is indicated by the peelings and refuse left in the nest. Thus the nest eventually becomes soiled; and since the animal is in other respects exceedingly sanitary, there is reason for suspecting that this alone eventually obliges the gopher to build a new nest. Also, it may well account for the numerous abandoned nests found in homes that have been in use for several years.

The position of the nest in the home and its size varies; winter nests

are nearly always placed deeper, and are made larger than the summer ones, although their construction is the same at all seasons. They are approximately round, the summer ones averaging about seven inches across, and those of the winter as much as ten. There is but one entrance, which also serves as an exit; this, judging from the behavior of caged animals, is usually closed by the gopher after its entrance into the nest.

We very seldom found the nest at the lowest point of the home, and it was nearly always at the end of a short side tunnel leading off from one of the main ones. The deepest found was eleven feet three inches, and the next just nine feet. But the average depth for winter nests was only six feet two inches, and that for the summer nests twenty-seven inches.

MOTHER AND YOUNG

As the time for reproduction draws near the female pocket gopher provides herself with an abundant supply of green shoots of plants and roots which she stores within easy reach of the natal chamber, thus enabling her later to devote all her time, for the first few days, to her offspring. If the nest, at this time, is not in first class condition a new one is made, in which event the evidence indicates that the fresh nest is placed nearer the surface than was the previous one. If this is so it accounts for the disparity in depths at which the various nests have been found. The nest in which young were actually found was twenty-seven inches below the surface. Another nest prepared by an expectant mother, and examined on June 11, was five feet eleven inches down. Several other nests dug out in early June, which were probably to be used for the reception of young, varied in depth from twenty-three to sixty-three inches below the surface.

While there is no doubt that these animals here produce only one litter each year, there is some question as to the number produced at a birth. The nest found with young in it contained three. Three other young were ploughed up on July 7. The dissection of nine gravid animals revealed: 1, 2, 1, 3, 5, 3, 4, 4, and 3 fetuses. It would appear, from the number of sterile females caught, that the young animals do not breed until they are two years old, but this has not been definitely proven. The young are born in June, and usually towards the middle of the month. Those dug out on June 14, 1927, were only two or three days old. They were a semi-transparent dark pink color, naked, blind and toothless. Their little bodies were thick set, or chubby; they had very short legs and tails. The cheek pouches were well marked but shallow.

When handled they uttered a low note more in the nature of a squawk than a squeak, and when exposed to the sun they displayed marked uneasiness. They were left in the nest for about twenty minutes, with the hope that their mother would visit them; but while she showed great anxiety for their safety, as was indicated by her filling in and blocking tunnels leading to, and close around the nest, she made no noticeable effort to approach or to take them away.

The information on hand indicates that the young remain with their mother until they are from six weeks to two months old. The earliest record I have of a young animal found away from its mother's home was August 2, and it weighed only 44.83 grams, so that it was not much larger than a field mouse. It is not known how far the young travel in a night, and the distance they ultimately go depends on several circumstances, particularly on the suitability of the surroundings for a home. Holes are often observed which have been dug as temporary shelters for the day, while in others the amount of work done indicates that the younger gopher had spent a week or more in one place before becoming dissatisfied and moving on. It is evident that some of the young animals, in this way, travel for several miles before they finally settle down to build a home.

MIGRATION

Apart from the annual movement of the young pocket gophers in search of favorable situations for homes, some evidence has been accumulated to show that the older animals occasionally wander over the country and that during very dry seasons they move from the high land to low, and if possible, damp situations. During August, 1928, three adults which had been killed by passing motor cars were found along a country trail and from all appearance they had traveled a considerable distance. Other instances of these animals' wanderings have been noted, and on one occasion in May, a gopher was observed to swim the Assiniboine river, about three hundred feet wide. The animal landed close to where I was standing, and it did not appear at all inconvenienced by its immersion. Despite this evidence, however, there is nothing to show that these animals undergo the massed migrations which have been witnessed in lemmings and other rodents.

HOMES

The information that has accumulated from the investigation of over twenty pocket gopher homes shows that, while the principle adopted

by the animals was the same in each case, the general arrangement was subject to variation. The deep tunnels were always present, and were always separated from the feed, or shallow, tunnels by an abrupt, almost perpendicular, passage leading from the one to the other. The nest was always found in the deep, and never in the feed tunnels. There was always a store chamber within easy reach of the nest, stocked with varying quantities of food depending on the season of the year. During the

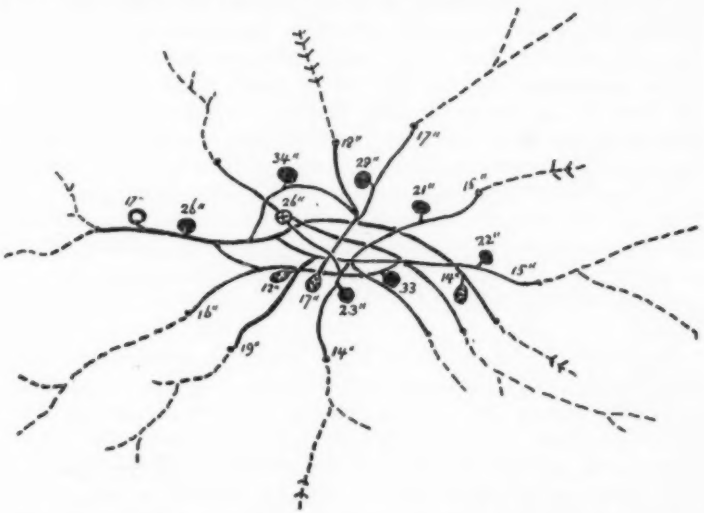

FIG. 1. Home No. 1, examined June 14, 1927. Continuous lines indicate the deep tunnels of the home proper. Broken lines are feed tunnels. Round projections are nests; those in black are old ones. The one marked with a cross contained the three young described. Elongated projections with dots are stores, and the figures denote the depths at which the objects shown were found.

autumn the bulk of the food gathered for winter use was always placed in store chambers excavated along the feed tunnels; these winter supplies were removed later to the lower store chamber, and from it, as required, to the nest in which they were consumed.

To make the following descriptive remarks on some of the more interesting homes more readily understood, I have divided the description of the gopher's home into two parts. The first relates to the deep tunnels dug for the safety and comfort of the animal, its nest, or nests, and

one or more deeply placed store chambers. As it is these deeply placed nests and store chambers that really constitute the animal's home, I have called this part the *home proper*. The second, that of the long, wandering, shallow tunnels and their many branches, because they are dug primarily for the purpose of finding food, I have called *feed tunnels*.

Home No. 1. June 14, 1927. This residence had been occupied for at least three years. Many of the early tunnels had been filled in, and some of them went to a much greater depth than any then in use. The deepest then occupied was only 43 inches. There were nine nests found, seven of which had been abandoned at different times. One nest was under construction, and the other, which was 27 inches down contained the three young mentioned under "mother and young." Of the three store chambers found, two contained food, part of which had been left over from the winter's supply, and the rest had been freshly gathered.

The total length of the deep tunnels then in use was approximately 167 feet, and that of the feed tunnels was 1164 feet. The home was on an old sandy field that had been allowed to go back to prairie grass, and among a large patch of the ground cherry, *Physalis lanceolata*, the roots of which had been made full use of by the rodent. See Store No. 1 beyond.

Home No. 2. November 2, 1927. This was typical of a young gopher's home in rather incomplete condition. The deep tunnels had the usual abrupt upward passages to the feed tunnels; the nest was at the end of a short side tunnel branching off from the one going down to the lowest level, and this took the usual sharp turn as its descended. The nest, which was 57 inches down, contained some food, but as yet there was no store chamber in the home proper. Three well filled stores were, however, found well out along the feed tunnels; their contents will be found listed under Store No. 2.

Thirty one feet of deep tunneling was dug out, the lowest passages being at a depth of seven feet, three inches. The feed tunnels were not extensive, 288 feet, but a great deal of work had been done on each side of them in following the thick roots of *Comandra* and *Lathyrus*.

Although numerous small insects are often met with in pocket gophers' homes, the one described above was unique in providing a new genus of Diptera and five new species of Scarabaeidae belonging to the genus *Aphodius;* these were all in or close around the nest.

Home No. 3. May 30–June 1–2, 1928. Locality close to No. 1. The construction of this home was the most remarkable of any of the series examined. It had been occupied for at least two years. The animal

had then in use 566 feet of feed tunnels, and when work was discontinued, owing to the enormous amount of labor required to expose the tunnels, over 50 feet of those composing the home proper had been examined. The first encountered, which was then in use, was seventeen inches down; beyond this and at the end of a hole coming up from the main tunnel six feet four inches down was a store, fourteen inches below

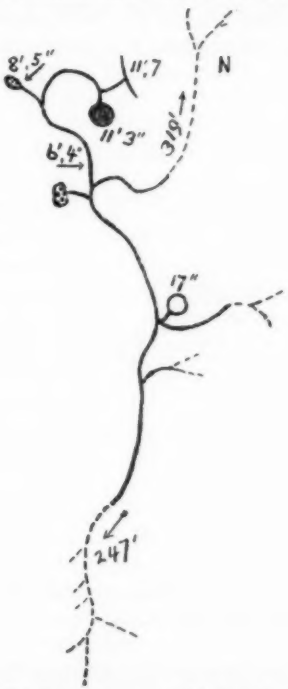

FIG. 2. Home No. 3. This home is remarkable for the great depth of the main tunnel, eleven feet seven inches.

the surface, containing a few cut lengths of cherry roots. The main tunnel, turning somewhat to the left, continued downward, and at eight feet five inches revealed a short side tunnel which entered a store of freshly gathered green fodder. The animal's hole now circled sharply to the right, while a cross tunnel went off at a right angle to the left; the former continued, but soon came to an end at an old nest eleven feet

three inches down. The left tunnel was now followed; it soon united with another. Both continued in a horizontal direction at a depth of eleven feet seven inches. After we had followed these a few feet our trench caved in and we gave up further digging.

In these last tunnels a considerable amount of the animal's dung was found, upon which a few Scarabaeid beetles and larvae were feeding.

Home No. 4. October 23 and 24, 1928. Locality sandy plain on virgin prairie. From the neatness of this residence (see Figure 3); one might be led to believe that the owner was artistically inclined. The

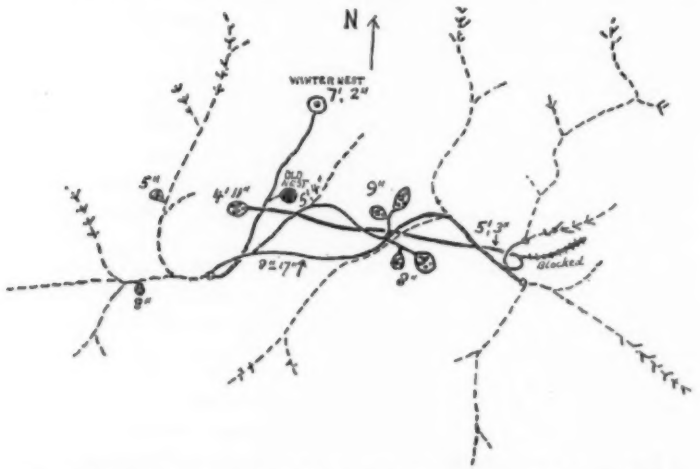

FIG. 3. Home No. 4, examined October 23 and 24, 1928. This home had been constructed in about three months.

home was a new one and the work had all been done within about three months. A few of the first tunnels dug had been filled in with earth brought up from the deeper ones. This is a common practice which often makes it almost impossible to tell, by the mounds of earth thrown out, in what part of the tunnel system the home proper is situated. It will be seen that the nest was at the end of the deepest tunnel seven feet two inches down. This deepest tunnel and the remains of a small one, five feet four inches down, that had evidently been in use while the home was under construction, were the only ones in the home. The stores were somewhat unusually placed, two small ones well out on the feed tunnels,

four larger ones towards the center of the home about nine inches down, and another at the end of one of the deep tunnels four feet eleven inches down; these seven stores were all well filled, and an analytical report of them will be found under Store No. 5.

Thirty-three feet of deep tunnels, and thirty-seven feet of semi-deep ones from eight to seventeen inches down, composed the home proper. The two hundred and seventy feet of feed tunnels showed that a great deal of work had been done along their margins by the animal in following the lateral roots of *Comandra*.

THE GATHERING OF FOOD

The shallow burrows have been termed feed tunnels, because their chief purpose is to aid in gathering roots and other material for food. I have already related how the ground on each side of these tunnels is often entirely dug over for many feet. Not only do the animals make numerous lateral excursions after desired roots, but in some cases they have been known to follow them in a semi-horizontal direction for fully three feet. As a rule the earth removed in this work is repacked into the holes so that the operations are not noticeable from above. It is not uncommon for the longer feed tunnels to dip suddenly to two, or even three feet, and to continue at this depth for eight or ten before again coming to the normal level. As this can have nothing to do with procuring food it is suspected to be a safety device against such enemies as the badger.

During the warmer months much green food is eaten. Of this broad leaved plants are preferred and among these members of the pea family appear to be most palatable, with green artemisia, *Artemisia dracunculoides*, a second choice, in fact this latter plant is preferred in its early stages of growth. When the vegetation is luxuriant and dense the gophers often emerge from their burrows to gather it, cutting the plants off close to the surface. They then pull the plants into the tunnel and cut them into short lengths, pack them into their pouches, and remove them to the nest or store chamber. If the plants are far apart and afford scanty cover for the animals, they usually tunnel close to the surface from plant to plant. When a plant is encountered its roots are cut and it is drawn down into the burrow.

STORES AND FOOD

The following analyses show the contents of a few of the more important stores. The selections have been made with a view to showing the

diversified nature of the food, which, it will be noted, depends very largely upon the relative abundance of the plants growing near the home.

Store No. 1. From home No. 1, on June 14, 1927. Part of this store was left over from the previous winter, and the rest had been recently gathered. The contents in percentages were: *Physalis lanceolata*, 83; *Petalostemon purpureum*, 3; *Helianthus rigida*, 1; and several bits of unidentified roots, some green shoots of *Artemisia dracunculoides*, and a few small lumps of dry cow dung. Weight about one pound.

Store No. 2. November 1 and 2, 1927. Locality low land, five feet from the water level, on edge of potato field with a narrow strip of sweet clover. The land had been ploughed some ten days previously and only one store was recovered. The contents of this in percentages were: Sweet clover roots, 80; potato chips, 11; *Convolvulus sepium*, 8; and other small roots, 1. Weight two pounds nine ounces.

Store No. 3. From home No. 2, November 2, 1927. This store was in three chambers, and the amounts by weight were: *Comandra richardsiana*, 1 lb. 7 oz. 14 drs.; *Lathyrus venosus*, 1 lb. 2 oz. 15 drs.; *Petalostemon candidium* 3 oz. 5 drs.; *Helianthus rigidus* 1 oz. 7 drs.; *Anemone patens wolfgangiana*, 1 oz. 3 drs.; *Solidago missouriensis* 1 dr.; *Prunus pumila* 7 drs.; and *Equisetum sp.* 1 dr. There were in addition to the above, a few roots of *Lithospermum canescens*, *Artemisia dracunculoides*, *Galium boreale*, *Rosa sp.*, three grasses, a sphinx pupa, a small green grasshopper, and several bits of sharptail grouse droppings. Total weight 3 lbs. 4 drs.

Store No. 4, November 3, 1927. Between mixed wheat and sweet clover on one side, and rye field on the other. The percentages from three chambers were as follows: Sweet clover crown and thick roots 67; wheat heads 27; rye heads 2; *Prunus pumila* 4. Total weight 3 pounds 11 ounces.

Store No. 5. From home No. 4, October 23 and 24, 1928. The store was in seven chambers, and the contents by weight were as follows: *Comandra richardsiana*, 4 lbs. 13 oz. 3 drs.; *Anemone patens wolfgangiana* 9 oz. 5 drs.; *Heuchera hispida*, 3 oz. 8 drs.; *Liatris punctata*, 2 oz. 7 drs.; *Prunus pumila*, 2 oz. 5 drs.; *Petalostemon candidium*, 2 oz. 5 drs.; *Helianthus rigida*, 1 oz. 11 drs.; *Rosa pratincola*, 1 oz. 3 drs.; *Allium stellatum*, 1 oz. 2 drs.; *Geum triflorum*, 3 drs.; and a few roots of *Galium boreale*, and *Campanula rotundifolia*, these, with a few that were unidentified, weighed 1 oz. 2 drs. Three grass species, and one sedge, 11 drs. Total weight of the store 6 pounds, 7 ounces, 5 drams.

Many other stores were examined, all of which bear out the above

evidence to show that there is little actual preference in the selection of food, but that the roots are taken as encountered. An exception to this rule might be suspected in *Comandra*, but as a matter of fact this plant is rather common, and its roots are encountered at about the average depth of the feed tunnels.

The captive pocket gophers were closely observed; besides being furnished with all the available garden vegetables, they were supplied with many roots and green food from garden, woods and prairie. The animals showed a marked preference for carrot, while onions proved least palatable. Parsnips, artichokes, potatoes, turnips, beets and radishes, and green pods of peas and beans were all eaten with apparent relish. Oats were preferred among the grain; but wheat, barley, rye, corn, flax, buckwheat, and sunflower seeds were all readily consumed. In many instances the large roots were dragged into the nest and eaten as required. However, if they were too large to be readily carried they were eaten where found. The small objects were usually gathered into the pockets and taken into the nest, or to its entrance. When a second box was placed in the cage this was used for storing surplus food. Nuts when furnished intact remained untouched, but when broken open were readily eaten.

It is well known that most rodents eat flesh, and many of them are cannibalistic. The pocket gopher is no exception to this rule; not only will it devour mice and other rodents caught in traps, but it also eats those of its own species discovered in a similar plight. Our captives appeared to do all these things, and would eat flesh, fish, or fowl. The species shows little indication, however, of being insectivorous, and its homes, as previously intimated, not only harbor many kinds of beetles and flies, but also camel crickets.

ECONOMIC IMPORTANCE

The economic importance of the pocket gopher is largely involved with agricultural production, and in this respect the animals' activities are yearly becoming more pronounced. This is especially so in districts where diversified farming has replaced the all-grain farm. The increased importance of the rodent under these conditions is due to the fact that grass and clover fields are less frequently disturbed by the plough, and that the plants involved furnish an abundance of choice food.

It has already been pointed out that the young pocket gophers, when about two months old, leave their mother's home to wander off and make one of their own. As most of the grain fields and gardens then

offer an abundance of choice food, the young animals very often commence operations in one or the other. Should the grain be in stock, the gopher generally used a stock for a starting point, piling the excavated earth in and around it. No sooner has a fairly comprehensive home been made than the rodent tunnels to the next stock and from that to others, each in turn being piled up with earth. This work continues until the sheaves are removed, or frost drives the animal from the surface. In the meantime innumerable heads of grain have been stored away, and many of the sheaves cut to bits. But even this damage falls into insignificance in comparison to that which results from the sprouting caused by the gophers' heaping of earth against the heads in the stocks.

Should the gopher in its wanderings arrive at a well stocked garden, it sets to work among some dense foliage, where its operations often pass unnoticed until a home is established. The animal next extends its feed tunnels, and as these usually follow beneath a row of vegetables, the resulting damage is soon severe. Carrots, parsnips, beets, potatoes, cabbages and artichokes are attacked with impartiality, while beans, peas, and melons suffer in a like manner. Flower gardens may suffer in a similar way, the injury being particularly severe to perennials. Caragana hedges provide another favorite forage for the animal, and my brother Norman has informed me of an instance in which one of these hedges was entirely ruined. Orchards and small shade trees are frequently damaged, the gopher either cutting their roots through, or gnawing the bark off of them. In this way young coniferous and deciduous trees eight or more feet high have been known to be killed in some numbers. In alfalfa, sweet clover and grass fields, not only is much damage done to the plants, but there is great wastage caused by the mounds of earth that cover the plants and interfere with the mowing.

Pocket gophers found, with the introduction of railways, that the embankments provided them with excellent sites for homes, and the ditches on either side furnished an abundance of choice food. The result is that these animals are now to be found along them, and the many motor highways, in great numbers. While the damage done is not very noticeable, there is always a loosening of the road bed, and an added danger in times of floods, caused by the water rushing through the animals' tunnels, and so causing wash-outs.

Besides the above mentioned losses, there is a secondary loss brought about through the utilization of the gophers' burrows by many other small rodents, which thus find refuge from their natural foes, the hawks and owls, and so carry on their insidious depredations unmolested.

CONTROL

The control of the pocket gopher is accomplished in two ways; firstly, by natural agencies, discussed in the following paragraphs; and secondly, by artificial control, which man is sometimes obliged to employ to keep the animal within bounds. The latter is not here treated.

Pocket gophers are subject to the attack of numerous predators which in pre-agricultural times probably kept them within bounds. The demand for furs in some cases, and ignorance in others, have greatly reduced these natural foes. Several species, however, still exist in sufficient numbers to be an important check on the gophers' increase. Among the most prominent of these are weasels, badgers, skunks, coyotes, or prairie wolf, foxes, and several species of hawks and owls. We can also include the domestic cat which catches a number of gophers around villages and farms. Of the animals thus enumerated the long-tailed weasel, *Mustela longicauda*, is the most important. My brothers and I have frequently observed this weasel in the act of carrying a pocket gopher to its larder, and twice it has been encountered in mid winter with freshly killed gophers in its possession. Not only does the weasel boldy enter the gopher's home to hunt the owner, but it often makes this its temporary headquarters from which to make excursions in search of other rodents.

The badger, *Taxidea taxus*, is another important hunter of the pocket gopher. This is amply demonstrated by the absence of further activities on the gopher's part, after the badger has left the home. As a rule this hunter secures its prey in one of the feed tunnels.

The value of coyotes, and of foxes and skunks as destroyers of pocket gophers, is much less than that of either the weasel or badger, although their activities in this respect are by no means negligible. It is unfortunate that all these predators are yearly becoming less numerous, and as they do so there is apt to be an increase in the creatures upon which they prey, with a corresponding loss to crops.

The value of hawks and owls has been demonstrated on a number of occasions when we have found pocket gophers in their nests. The red-tail, Swainson, and ferruginous roughleg hawks are the most important in this respect.

Owls' nests frequently contain the bodies of pocket gophers about the time the young birds are hatching; and the disgorged pellets found round about reveal the remains of many more. This is to be expected when it is considered that both the owl and rodent are active at the same hours. The western horned owl appears to be the most prominent in this work,

although the long-eared owl is not beyond picking up a gopher when opportunity offers, and other species do likewise.

Dr. Ralph D. Bird of Birtle, Manitoba, has kindly furnished me with the following valuable information, taken from investigations he made near his home, (See Canadian Field Naturalist, Vol. XLIII, No. 4. April 1929). In this study a large series of western horned owl pellets were examined, and among the many different items of food determined were the bones of seventeen pocket gophers. The first of these was found on May 8, and the last on June 2. Not the least interesting of Dr. Bird's report is the fact that eleven of these rodents were accounted for between May 22 and 30. While this is rather late in spring, the supposition is that these animals were taken during the mating season, or at its close when they were returning to their homes.

NOTES ON SOME MAMMALS FROM BARRO COLORADO ISLAND, CANAL ZONE

By Robert Kendall Enders

[*Plate 16*]

The field work upon which the following notes are based was done at the Institute for Research in Tropical America, Barro Colorado Island, Canal Zone, between June 19 and August 11, 1929. The trip was made possible by the support of the Museum of Zoology, University of Michigan, Dr. A. G. Ruthven, Director, and Dr. L. R. Dice, Curator of Mammals, Dr. Thomas Barbour, director of the Institute, and the United Fruit Company which furnished transportation to and from Cristobal. Any credit due this work must be shared with Dr. James Zetek, Resident Custodian of the Institute and his group on the island for their advice and assistance. Drs. A. H. Shultz and G. B. Wislocki gave considerable aid during the early part of the summer; Mr. Julius Johnson identified some plant material and aided in securing photographs. Thanks are also due to Mr. A. B. Howell for aid of various sorts and for the identification of the bats; to the Biological Survey for the loan of specimens, without which determination of some of the species would have been difficult or impossible; to Drs. Dice and Murie for many favors; and to Mr. Wm. P. Harris for the identification of the squirrels.

SUB-ADULT FEMALE NIGHT MONKEY, BARRO COLORADO ISLAND, CANAL ZONE. JULY 31, 1929

While considerable work has been done on the mammals of Panama it has been mainly from the systematic viewpoint. Moreover, it is doubtful if such an intensive study of a small area has been attempted before. Goldman made notable collections in Panama during 1911 and 1912, and Anthony also collected, much of his work being done in the Canal Zone, during 1914 and 1915. Most of the collecting of both men was done in the dry season, and some with the aid of hunters.

This study was carried on in the rainy season. It was limited, except for an excursion to the Chilibrillo Caves, to Barro Colorado Island.

As soon as possible after arriving, food was scattered about at various places to determine which foods were most frequently taken and the most promising locations for traps. Traps of various types and sizes were used, ranging from the small snap trap and Delusion trap to a Number 4 steel trap and a large home-made live trap. The most successful trap was the Springfloor Rat Trap. The Schuyler Trap and the large size snap-trap were moderately useful, but the small snap traps and live traps were worthless. While traps were used, the main reliance was hunting, particularly for the larger mammals. During the summer practically all the trails were hunted once, some of the more productive being gone over about once a week. Mammals were observed as much as possible, only enough specimens being taken to insure identification. Where this was not necessary because of size or visibility, none were collected. This applied particularly to the monkeys and deer. Since specimens were not the main object, little hunting was done at night.

In trapping, the line was visited early in the morning; at about four o'clock in the afternoon to rebait, as the bait was almost always taken or spoiled by insects or crabs; and again at 9:00 P. M., in order to collect whatever had entered them during the evening. The facilities of the Laboratory were really appreciated when on returning from the trap line the specimens could be placed on ice to be skinned the next day.

Barro Colorado Island offers unique opportunities to a mammalogist interested in life histories and distribution. The island offers several distinct types of habitat; the concentration of mammals is almost unbelievable; and the facilities for observation are unequalled. The trails offer glimpses of many of the larger mammals; and the small rodents, which are usually so difficult to collect in the tropics, are here almost as easy to collect as they are in some portions of the more temperate regions. The laboratory is well equipped with cages, there is an abundant supply of foods, and the caretakers are skillful in caring for mammals.

Didelphis marsupialis etensis. Three specimens of this opossum were taken. One was taken in a steel trap set on the trail, in the brush near the clearing; one in a live trap baited with banana; and one in a Schuyler trap set on a small mammal trail on which spiny rats and Marmosa also were taken. The first one taken was removed from the trap and carried by the neck to the laboratory. During the trip he grasped with his tail at everything small enough to encircle, but did not attempt to climb a six-inch tree when given the opportunity. The resistance offered by the prehensile tail was remarkable. Like the other two specimens, this one was kept alive in the laboratory for a few days feeding on bananas and the carcasses of mice, but was finally killed on account of its strong odor. While in captivity, they spent the day curled up under the bedding, but were more active at night; they used much water. The female, captured August 2, had two pouch young attached to her teats. The young were able to use their fore-limbs and head and neck, but did not move their hind limbs or tail even though stimulated to do so.

Two of the three, one male and one female, were sub-adult, lacking the last upper molar, and two had the black phase of pelage.

Marmosa mexicana isthmica.—Murine opossum. More specimens of this species were obtained than of any other. They were taken in live traps of several types; in the forest, beside logs, in brushy tangles, near the clearing, and one was seen in the banana plantation. They were attracted by papaya and banana—both being used for bait and food. In captivity they took these foods, but starved to death rather than eat sweet corn or cocoanut.

One individual observed for a week or more slept in the typical rodent position with the head tucked between the hind legs. Another lay on its side like *Didelphis*. Specimens in a large outdoor cage crawled into the corners among the rafters. One bad-tempered female was kept for some time. Two days after her capture, two recently-captured young about one-third her size were placed with her; they had been captured thirty-six hours later than she, about one hundred and fifty feet from the trap she had entered. She adopted them at once, for when observed the following morning, all three were lying together under a cloth on the cage floor. The young were lying on the female more or less embracing her. When disturbed, one was separated from her, the other one hanging on to her with its mouth seizing the fur behind the right front leg. Later both were seen holding on thus. This female showed remarkable courage. When a hand was placed near her, she would jump at it, hissing, with her mouth wide open. The two young were equally aggressive, for while the cage was being cleaned, they were placed with some spiny rats, and when a full-grown rat approached the corner where the young opossums were, one sprang at the rat with open mouth making a noise like the parent. The attack was directed at the rat's head, but whether the opossum bit the rat or not could not be seen. The attack was, however, sufficiently effective to drive back the rat, and keep him at a distance. One adult individual bit me while moving her from a live trap, inflicting, with an upper canine, a cut an inch in length. When animals of this species were being photographed they assumed a typical defense pose: head up, mouth open, one forefoot upraised as if to strike.

This species may begin to move about before dark, for one was surprised on a

fallen bunch of bananas at dusk. Other individuals were collected after dark—7:30—and several were taken between 4:00 p.m. and 9:00 p.m., so it appears that they do their foraging early. When exposed for some time to daylight their eyes water, a cloudy film may appear, and the animal looks very miserable. During most of the day, captive specimens lay under the litter, but came out before dark to eat. In eating a banana that was lying on the floor of the cage, the position of the body was rat-like, except the tail, the proximal portion of which was held above the floor and straight, while the distal four inches was cork-screwed. Later the tail was placed over the banana with only the extreme tip curved from dorsal to ventral, in a semicircle—three-eighths of an inch across.

Young, one-third grown, were taken on July 15; a half-grown specimen on June 24; and all the females examined up to July 12 were nursing, so the breeding season, if there is a definite season, may have been over. The mammae of one nursing female occurred in an area 3 cm. by 2 cm. with six mammae on the left, five on the right, one in the median line. The milk was semi-clear, lymph-like.

To judge from the numbers taken and the number of habitats in which they were found, it appeared to be one of the most abundant mammals in the vicinity of the laboratory.

Bradypus griseus griseus.—Three-toed sloth. No sloths were seen on the island. In 1925 Wislocki and Richter released approximately six individuals of this species that had been obtained from natives in the vicinity of Frijoles.

Choloepus hoffmanni.—Two-toed Sloth. None were seen.

Cyclopes didactylus dorsalis.—Two-toed anteater. An account of this species on the island is given by Van Tyne (Jour. Mammalogy, Vol. 10, p. 314).

Tamandua tetradactyla chiriquensis.—Anteater. Six anteaters were seen during the summer. They are probably more abundant than this indicates, for one cannot see far in the jungle. Five of the individuals were surprised while on the ground, and took to a tree in every case, keeping the trunk between themselves and danger; the other was in a tree when first observed. They are not strictly nocturnal, for they were seen moving about at 4:30 p.m., 6:30 a.m.; and 10:00 a.m. on a rainy day. They do not move very quietly, because they are rather clumsy walkers. One afternoon at 4:30, Drs. Wislocki, Shultz, and I paddled into a small cove and saw an anteater moving leisurely across a small stream. On seeing us land she made for a small tree which she was prevented from climbing by vigorous use of a paddle. Once on the ground she lay on her back striking with all four feet while one of us stood on her tail. This she stopped by standing on her hind legs and striking powerful blows with her forefeet at her captor. After she had recovered herself enough to sit on her haunches, she fought with the front feet only, planting her hind feet wide apart, with her tail straight back and pressed against the ground. After some time she gained a small tree up which she went in spite of all we could do; it was impossible to shake her hold, so she passed to a larger tree into the top of which she disappeared. This same willingness to fight was found in all the individuals that were cornered or wounded, and all fought in the same manner. None of them reared up on their hind legs so that the hindquarters and tail were off the ground.

The stomach of each of the specimens collected held about a pint of ant larvae. Apparently ants had attacked the raider while she was feeding, for on one were found many ants that had attached themselves in the tenderer portions of the inguinal region, and under the axilla, clinging on even after they had been killed. Round worms were found in the stomach of one.

Both specimens were females; one had a cystic ovary, the other had two pairs of well-developed mammae, both pectoral.

Dasypus novemcinctus fenestratus.—Armadillo. Although tracks of this species were seen, only one specimen, an immature male, was captured. He was picked up on the trail at 5:00 p.m. He was placed in a cage where he spent the night trying to escape. Next morning we placed a string around a hind leg and took him out into the jungle to observe feeding habits. He plowed along with his snout in the loose litter of the forest floor, pausing from time to time to dig, which he did with the forelegs with great rapidity, but did not make any attempt to dig in. The ability to climb banks was very remarkable. The animal scaled a perpendicular bank of clay by taking advantage of very slight projections. While it was impossible to determine what he was eating, it is thought that it was larvae found in the litter. When he found something, he paused long enough to eat it, then hurried on. Part of the day he spent coiled up under the excelsior, part in rearing up to sniff the breeze. There was a strong characteristic odor.

Pecari angulatus bangsi.—Collared peccary. Peccaries are very numerous on the island, and were seen oftener than any of the other large mammals. They appear to be most numerous where the cover is fairly dense and near some of the streams on the more level portions of the island. Tracks were found almost everywhere and many trails led through the undergrowth. Most of these trails appear to have a stream, a wallow, or a palm nut tree as their terminus. The ground beneath many of the palm trees had the appearance of a pig-pen, because of the activities of the peccary, which, in common with the squirrels and coati, are very fond of the pulp covering the seed of the palm nuts (*Attalea gymphococca*, *Acrocomia sclerocarpa*). Some of these trees had been rubbed smooth by the animals using them as rubbing posts.

One smells peccaries more often than one sees them, for their odor hangs about their haunts, as well as about the animal. When in doubt as to the users of the trail, it is only necessary to smell a few twigs at the level of a peccary's back to catch the odor, if the animals have been along recently. A young captive did not give off much odor, but when petted would erect the hair about the dorsal gland, trying, at the same time, to rub the gland against the petter. The odor of the gland was characteristic and difficult to remove from the hands.

The sounds made by the peccary vary from a puppy-like bark with a pig-like turn, to a deep coughing grunt, when one is suddenly disturbed. The range of sound is great; typical sounds accompanying many activities such as the grunting note of contentment while feeding, and the pig-like squeal when one is bitten by another. The voice of the old boar carries something of a challenge in it, and is usually given just before he disappears into the undergrowth. One group ran away when disturbed, some individuals uttering a grunt with every jump—very much like a domestic pig when pursued.

Peccaries feed, probably, by day and by night. The captive peccary was ready to play at all hours of the day or night in marked contrast to the monkeys and deer. On moonlight nights he appeared to take great delight in pushing the tin pan from which he ate about his pen; this was not noticed to any great extent on dark nights. Several groups were seen feeding. One such group was moving along the trail rooting here and there as they traveled along; another was found under a palm tree eating the pulp from the nuts. Both groups were heard before they were seen. The largest group contained about ten individuals, another nine; but groups of two and three were also seen, as well as solitary individuals. It appeared that solitary individuals stood their ground better than herds, or they may have represented a rear guard to a herd that had moved off on being approached.

Having read much about the attacks of peccaries, I was afraid of them, but after having seen several bluff for a moment only to fade out of sight, I was no longer worried about attack. One group that I surprised, or that really surprised me, was at the junction of three trails. I took a shot at one; the shot was wild. It served, however, to divide the herd into two groups, the smaller of which came back over the trail to rejoin the main group and in so doing passed within twenty or thirty feet of me. Another group was similarly divided by killing one of their number; again two or three that ran in the opposite direction to that taken by the herd ran back across the spot where the one had been killed. From these experiences I was convinced that if one did not get between sections of a frightened and divided herd that there was little danger from peccaries; this impression was rudely shaken later. A rather large individual, which may or may not have belonged to this species, was started about two hundred feet ahead and one hundred feet to the side of the trail. Instead of the usual bluffing and disappearance he started toward the trail, but before reaching it turned parallel to it, kept on coming, and passed within thirty feet of me. After passing, he bolted. His approach was so deliberate that in my haste to change the light charge in my gun to buck shot, the desirability of an accurate identification was overlooked.

Although the individuals seen varied considerably in size, no small peccaries were seen. The specimen collected carried two well-formed embryos (July 16). There was a liberal amount of fat on her shoulders and in the omentum. She weighed forty-six pounds. The flesh was fairly good eating, but stringy and dry; however, five natives ate the entire carcass in two days. Failure to remove the dorsal gland until two hours after death did not taint the flesh. A skull was found in a water course.

Tayassu pecari.—White-lipped peccary. Chapman pictures this animal from the island. None was seen unless the big one referred to above belonged to this species. On the trails lying beyond the tower many large tracks were seen which might have been made by this species.

Mazama sartorii reperticia.—Brocket. Deer have not been seen often on the island. One was seen on July 4, and another on the 10th. After firing two shots at other game, I had proceeded along the trail for one hundred yards when a deer jumped up about forty feet to the left of the trail. It took four bounds, white tail up, then glided away at a swift trot with the tail held down so that no white

showed. Deer were seen near the trail several times later, but it was almost impossible to identify them unless they started near a trail, or crossed a trail in their flight. No deer or deer tracks were seen between the laboratory and the tower until after an ocelot had been taken on that trail; after which deer were seen three times within a month and a half.

A young captive buck was kept in excellent condition in the laboratory inclosure on a diet of grass and bananas, the skins of the latter being eaten as well as the fruit.

Oryzomys fulvescens costaricensis.—Rice rat. Two specimens were collected and another seen. The first rice rat taken was a pregnant female, July 15, and was captured in a nest of grass located under the eaves of one of the buildings. Another was shot at 9:15 p.m. by the light of a head lamp. When first seen, it was trying to reach a bank by moving with great rapidity from one bunch of grass to another. When the light was thrown full on it, it remained still, crouching behind the grass. The stomach contained some purplish fruit pulp. While setting traps under one of the houses, I found a nest of grass on the surface of the ground under the eaves, but not under the house, the floor of which was several feet above the level of the ground. The nest was like the one from which the female was taken, consisting of dry grass cut into pieces arranged in a blind tunnel under a tuft of grass. There was no depression in the ground, nor was the floor covered with cut grass; the center being a simple chamber, not much enlarged. The whole structure appeared to be loosely made from long grass stems intertwined with the tuft of grass that marked the nest site. Several times the occupant was disturbed, each time running under some lumber stored under the house. No runways were found about the nest. Trapping proved unsuccessful, but the animal was seen often enough to make identification fairly certain.

Rattus rattus rattus.—Black rat. A single specimen was taken in the laboratory on a rafter near the storeroom.

Proechimys semispinosus panamensis.—Spiny rat. For a time it appeared that this was the only rodent that would enter traps—the only other species comparable to it being *Marmosa*. These rats were numerous in the woods, where they used the many small trails in common with *Marmosa* and *Didelphis*. They were taken in live traps of several types, and in rat traps; about logs, on trails, near the edge of the banana plantation, and in the long grass along the edge of the lake. Bait taken was banana, fresh sweet corn and cocoanut. The specimens collected in the deep grass near the water had grass in their mouths although they had been killed instantly. Grass was found in their stomachs also.

Several were kept in captivity to which they took readily, feeding on the foods used as bait. In eating bananas, the skin at the stem end was taken between the teeth, then with a turning and raising of the head the skin was stripped off as far as could be done without moving the body. At times the forefoot was placed on the banana to hold it on the floor while it was being peeled. When offered fresh sweet corn, the soft portions of the kernel were eaten, leaving the outer tougher coat. *Marmosa* young were able to drive a full-grown rat away from food. Some of the specimens could be picked up with safety; one bit an Indian who was cleaning the cage.

A large male was placed in a cage with a Boa. The rat tried to escape all evening, but was very calm next morning as the snake did not pay much attention to him.

One tailless individual was taken, as well as several with tails that had been injured at the base but healed. One of these had a very definite crook in the tail near the base.

Dasyprocta punctata isthmica.—Agouti. Agoutis were abroad at all hours of the day except between 10:30 a.m. and 3:15 p.m. and were the most frequently seen of the rodents. On rainy days they moved about later in the morning than on clear days. Several were seen feeding as late as 9:00 a.m. or as early as 4:00 p.m. on bright days. In feeding they moved about the forest floor, smelling here and there. What they were eating could not be determined either by observation or by stomach examinations.

When mildly surprised, they run at a very fast trot that is very unlike a rodent's gait, and break into a gallop when frightened. On being disturbed suddenly they give voice to one or two loud, squealing barks as they bolt for cover. On one ridge their burrows were located just over the brow, from which radiated paths to the top of the ridge along which they fed. When surprised, most agoutis ran for their burrows, but a few dashed in the opposite direction to tangles of vines and trees under which no burrows were found.

Agoutis appear to fight much among themselves, for the majority of those taken had torn or nicked ears, and some had long parallel scratches that might have been made by the claws of others. These scratches were from 7 cm. to 9 cm. long and from 3 cm. to 4 cm. apart, appearing on both sexes, usually on the hindquarters or shoulders. Ticks and fleas are abundant. Some individuals had spines of the palm under the skin. A bright orange fungus-like growth sometimes appears on the margins of the ear, and in spots in the axillary region. This growth was found also on the coati.

Pregnant females were taken July 4 and 10, but an adult taken August 5 was neither pregnant nor nursing. Only one sub-adult was seen.

The flesh is firm and white when cooked and is good eating if one can forget the strong odor so much in evidence during skinning.

Coendou rothschildi.—Porcupine. Two quills of porcupine, probably of this species, were found sticking into the neck of an ocelot, and one so deeply imbedded in the shoulder that it was not seen until the skin had been removed.

Sciurus gerrardi morulus.—Squirrel. It would have been possible to collect a large series of this squirrel on the island for they are numerous and active—each palm tree appeared to act as a magnet for all the squirrels in the neighborhood. Here they come to eat the yellow pulp that lies under the outer husk and around the nut, and to carry some of the fruits away. I watched one individual cut off three nuts, cram two into his mouth—how he did it could not be seen—take a third nut between his teeth, run to the end of a frond, then jump to a vine up which he climbed to a large lateral branch of a tall tree. On the way up the vine two of the nuts were lost. Sitting with his brightly colored tail closely appressed to his back, in which position the color was not easily seen, he tore off the outer covering of the nut. This he did by holding the nut in his forepaws, taking the husk in his

teeth and with movements of the head upward and backward, and of the paws downward and forward, tearing off the husk in seven pieces, rotating the nut after each effort. With this accomplished, he ate the soft material surrounding the nut, revolving it in his forepaws until only the nut proper was left. After dropping the remains, he took another nut that appeared to have been wedged into a small fork, then ran off through the trees, moving slowly and mounting higher and higher. Other specimens were seen cutting off nuts, eating nuts in nearby trees, and traveling with them between their teeth. Two juvenile squirrels were seen carrying pieces of freshly-cut green leaves up a tall tree.

These squirrels may be led to scold much after the manner of the northern red squirrel, *Sciurus hudsonicus loquax*, and by much the same methods. The scolding note tends to be deeper in the Panama squirrel. Not all would scold, but several individuals, upon finding me sitting quietly near the trail, came down to scold. One scolded me after I had fired a shot at other game.

When traveling, some were seen to come down a tree, run over the ground to another tree rather than go from tree to tree through the interlacing branches. Lianas and vines were used skillfully as highways.

A female with embryos 15 cm. in length was collected June 27. There were three pairs of mammae. Two half grown young were seen and one collected July 27. The testes of several of the males were large and apparently active.

Microsciurus alfari venustulus.—Pygmy squirrel. One specimen of the pygmy squirrel was collected and another seen. They are difficult to see and even more difficult to shoot. The individual shot was hanging, head down, motionless near the base of a tree and almost escaped observation: the other ran across the trail, staying on the ground even after reaching the opposite side. Trapping in the locality proved barren.

Nasua narica panamensis.—Coati. Coati were seen on all parts of the island and at all times of the day. They appeared to eat about anything from fruit to carrion and garbage. Along many of the trails and over the forest floor were found the small pit-like depressions made by the long mobile noses of these omnivorous mammals. These depressions are much like those made by the armadillo and, possibly, in search of the same food, for one large female had more than a pint of grubs mingled with dirt in her stomach; the area over which she had been feeding showed the typical depressions. Individuals were seen feeding in this manner very frequently, although none had been living on such a strict diet of grubs as had this nursing female. Probably birds and eggs are eaten at every opportunity. One was observed feeding on a spiny rat that had been trapped. The stomach of the rat was neatly cut out and left along with the intestine, some skin, and the foot by which the victim had been caught. Others were seen feeding high up in trees, and many were seen about palm nut trees.

One large group consisting of both adults and young was seen feeding under a palm nut tree; one individual was on the bunch of nuts, the others were on the ground digging; still others were eating the pulp from about the nuts. The young were quarreling with much noise. While I was watching them, an old male came along the hillside to within twenty feet before seeing me. Surprised, he ran up a small tree for some five feet, making a noise like "Woof!" Two of the party

under the palm tree took to trees, when they heard him give the warning. The young, some six in number, made off through the undergrowth, while the coati on the stem of the palm nut moved to another tree. The old male that had given the warning hung to the tree trunk hissing and swinging his tail with violence until shot. At the shot, the coati in the trees came down and ran away on the ground.

At noon one clear, sultry day, a group of seven came to the clearing to eat garbage. They were not much disturbed by our presence, but nosed about with tails held straight up as they usually do while feeding. While they are digging the back is arched, the tail held stiff at a forty-five degree angle, the forepaws are used alternately, and the nose is used frequently, to locate the food. Two females were coaxed into camera range by tossing bits of banana to them. These they saw flying through the air, ran to the spot where they had fallen, and then located them by smell, poking their long noses through the debris until the pieces were located. Since the day was oppressively hot, the coatis kept their mouths open, but their tongues did not hang out. So many coatis visit the clearing that it is necessary to place metal sheets about the bases of the papaya trees to prevent them from consuming the fruit before it can be gathered.

The amount of curiosity displayed by some individuals is remarkable. A solitary young male was seen in a tree. When he discovered me, he ran out on a limb lashing his tail, hissing and spitting as he watched. I did not move, and he came nearer by moving rapidly to a mass of vines from which he descended a sapling head first until he reached a point five feet away from where I sat. He dropped the last few feet to the ground and then made off as fast as he could. Another worked down the trail toward me turning his head from side to side and peering at me. He appeared to forget me in his interest in feeding until he was about six feet away. Looking up at me, he hesitated an instant, then bolted off. On several occasions coatis were seen to climb a few feet into trees or up wild pineapples in order to see over the undergrowth; one climbed out on a limb to watch our activity around one of the huts.

Under several palm nut trees where they were well protected by fallen fronds, well-worn resting places were located from which coatis were frightened. Several individuals had palm spines under the skin.

Great individual variation in color, markings and size was observed. Two nursing females were seen and several parties consisting of several older individuals and young. One pair was collected while feeding together in a tree.

Felis pardalis mearnsi. Ocelot. The remarkable difference in size between the fore and hind paws makes it difficult to be positive about the tracks of the ocelot. Tracks were seen frequently on certain trails, notably the Barbour, Lathrop and Miller.

One specimen was taken more by accident than design. A set of three traps was made where the trail passed between two trees, the traps being a number 4, and two number 2 steel traps. An opossum was captured; then the set was unproductive for a week. At 11:00 a.m. Dr. Shultz was near the set observing some *Cebus*. The monkeys appeared to be alarmed and excited so he sat down under a small tree to watch them. By calling he induced them to approach within eight feet of him. They displayed considerable alarm. He left the spot at 11:45 noticing that the set was undisturbed. At 4:00 p.m. Dr. Wislocki and I arrived to find the

large trap with its drag gone. As the drag was only three feet long, a large mammal could move it with ease. An area some twenty-five feet in diameter, about a hundred feet from the set, was trampled down, and a two-inch tree had been scratched up to a point about three and a half feet above the ground. These scratches did not appear to be made by claws, but by the effort to free the paw from the trap. As no trail led away from the spot it was some minutes before the ocelot was found. The specimen proved to be a young male in excellent condition; he was crouching between the buttresses of a tree some ten feet from the set. He had been caught by three toes of the left front foot which held him through all his efforts to remove the trap, and finally when the drag had caught, it was so securely wedged between a sapling and the buttress of a large tree that it required two of us to dislodge it.

Two porcupine quills were found sticking into the neck and one was imbedded under the skin of a shoulder. Many ticks were found between the toes, but otherwise the animal was unusually free from ectoparasites.

The stomach contents consisted chiefly of the remains of spiny rats (*Proechimys semispinosus panamensis*). A few hairs that might have been from a peccary also were found.

To one side of the Barbour Lathrop trail a three-inch tree with scratches extending from about three and a half feet down to two feet was found. It gave the appearance of having been clawed by a large cat much as domestic cats claw trees without making any attempt to climb. This part of the island gave the appearance of having a larger or more concentrated cat population than any other.

From his sketchy observations, the author believes that ocelots are the most numerous cats on the island; that they pair off, and sometimes hunt in pairs, calling back and forth as they go; that they hunt over limited territory; that they are active at almost all hours; that the dung is not covered; that agoutis, spiny rats, and snakes form a goodly portion of their diet.

Herpailurus yagouaroundi panamensis.—Yagouaroundi. Two of these cats were heard on one occasion just before dawn, but could not be seen. Donato, the caretaker, saw two of them near one of the storehouses a few days later, at about the same time of day.

Saccopteryx bilineata bilineata.—Lesser white-lined bat. A. Brazier Howell took four specimens from a big tree. They were hanging on the bare bark, and not in cracks or between buttresses. I shot a specimen that flew from a shallow depression of a big tree, as I was passing. A bat, possibly this species, was started from a large hollow log.

Carollia perspicillata azteca.—Short-tailed bat. These bats were abundant in a large hollow tree which they shared with *Phyllostomus verrucosus*. They had a temperature of 99.2°, with the air at 79°.

Phyllostomus verrucosus.—Spear-nosed bat. Abundant in the hollow tree occupied by *Carollia perspicillata azteca*. The Panama representatives of this species are slightly larger than the topotypes—the forearm averaging several millimeters longer. This record extends the known range of this species, southward from Oaxaca, Mexico.

Myotis nigricans.—Little black bat. This small bat was very abundant about the laboratory, the caretaker finding some difficulty in keeping them out of the attic. Numbers of them were seen hanging from the eaves every day. In the course of some repair work, when a few strips of wood under the eaves were torn out, about one hundred *Myotis* and twenty-five *Molossus coibensis* took flight as a result of the disturbance.

Molossus coibensis.—Coiba Island mastiff bat. Abundant about the laboratory building.

From time to time very large bats were seen flying over the clearing. These may have been either *Vampyrus* or *Phyllostomus hastatus*.

Aotus zonalis.—Night monkey. Donato volunteered to show us a tree in which a pair of these monkeys were living. Only one night monkey was seen. It was in a tree-top in a mass of vine into which it was moving when seen. The time was 9:30 a.m. on a cloudy dull day.

An immature night monkey was secured from hunters and kept in the laboratory. She was about a quarter grown when taken July 2nd, and grew very rapidly on a diet of evaporated milk and banana. Her greatest fear was displayed when she was placed on the floor. As soon as she was left, she set up a chattering punctuated by a whistling "Khoo," and made for the nearest pair of legs. Up these she climbed, not resting until she was perched on a shoulder. She spent the day in a small hammock in a cage, whistling and chattering when hungry or alarmed. One of her most noticeable characteristics was her sensitiveness to temperature change, for on dark, cool days (74°–78°), she would complain unless covered.

Her eyes were useful in bright sunlight, for when placed on a bush for photographing, she followed every movement; nor did she make any mistakes such as running into objects or taking hold of or climbing anything but human legs.

Leontocebus geoffroyi.—Squirrel monkey. The marmoset is a very common mammal on the island, occurring, usually, in small groups. When disturbed, they give a high chattering note, which is usually what draws one's attention. The single specimen collected had seeds in its stomach; they undoubtedly eat a wide variety of foods. The specimen shot was mistaken for a squirrel.

Alouatta palliata inconsonans.—Howling monkey. The howlers are truly remarkable vocalizers, and may be heard almost every day. The passage of airplanes appears to disturb them more than any one thing; but they howl frequently when no plane is about. With care it is possible to pass under a group without disturbing them, but too much noise, or a coughing bark will set them going. There are several groups on the island; each group appearing to have a more or less definite range, but this was not determined exactly.

On two occasions when ocelots were heard, the howlers were quite noisy; it may be that the ocelots were hunting them.

Cebus capucinus imitator.—Colombian white-throated capuchin. A group came to a large tree near the clearing every evening for three days, then did not occupy it again for a month, then returned to the same tree again.

As this tree is in full view of the laboratory, an excellent opportunity was offered for observation. The animals walk along the limbs of a large tree with a decided hump just behind the shoulders, half of the tail extending in a line with the body, the remainder hanging down. They have two methods of making a leap when they have a definite branch or trunk in view, they jump to it with only the forearms extended, but if the objective is a mass of vine and tree-top, they just drop onto the mass without attempting to single out any hold, landing much as a circus performer does in a net—but *Cebus* lands on all fours, instead of on the back. Once in a while an individual would grasp a dead or weak branch; one was seen to fall after trusting to such a branch, but the fall was short and did not have any noticeable effect.

While moving from place to place *Cebus* does considerable calling back and forth. The group moves in a definite direction, but is usually much scattered—possibly the calling is to keep the members together. One male scolded me for some time, venting his spleen on the branch upon which he jumped up and down. The falling of dead limbs, when a group of *Cebus* is disturbed is probably due to this habit of shaking limbs rather than to any intention of throwing them down.

AUDITORY OSSICLES OF LIVING AND GIANT BEAVERS

By Alvin R. Cahn

[*Plate 17*]

Undoubtedly the rarest bones which the student of mammalian paleontology encounters are the auditory ossicles. This is due partially to the fossilized condition of many skulls, to their frequent embedment in a hard matrix, and no doubt partially to the very small size and delicate form of the bones themselves. I consider it fortunate, therefore, that I have recently recovered a complete set of ear bones from a fine skull of the Pleistocene beaver, *Castoroides ohioensis* Foster, unearthed during October, 1929, at Bellflower, McLean county, Illinois, and now the property of the Natural History Museum of the University of Illinois. As the ear bones of this species are unknown, a note concerning them may be of interest.

As to the skull itself: The present specimen is one of the finest yet found, lacking only the jugal element of the zygomatic arch and certain pieces of the posterior region of the palatine bone. It is stained a rich brown color, and the auditory ossicles show the same coloration. From the stratigraphic position of the skull we know that this particular individual lived during the Early Wisconsin interglacial period of the Pleistocene, in what Leverett calls Substage 1, which is the earliest

division of that era. It lay at the base of the outwashed gravel of an old glacial lake of the Champaign moraine which, in McLean county, overlies the Shelbyville till sheet. This assignment is further verified by Prof. F. C. Baker, curator of the Natural History Museum, who has identified thirteen species of Early Wisconsin Pleistocene gastropods recovered from within the brain case and the tympanic bulla. Therefore we may assume that the skull is some 50,000 years old, though the age of the Early Wisconsin material has not yet been determined in terms of years with any degree of accuracy. The recovery of the ear bones was made possible only because no solid matrix of any sort was associated with the skull. A pipe cleaner was inserted through the external auditory meatus and gently manipulated inside of the tympanic bulla. In the debris shaken from this cavity, consisting of particles of gray clay and a few gastropod shells, were found all three of the ear bones, complete and perfect, unbroken except for the distal portion of the manubrium of the malleus, which is lacking.

It has also been my good fortune to recover a complete set of the auditory ossicles from a skull of the modern beaver, *Castor canadensis canadensis* Kuhl, collected by Mr. Jack T. Kemp on Knife lake, Ontario, Canada, in August, 1928. Thus I am able not only to describe the ossicles of the fossil beaver, but to compare them with those of the modern species. For this privilege I wish to express my appreciation to Prof. Baker in so far as the *Castoroides* is concerned, and to Mr. Kemp for the *Castor* material.

As to the literature on ear bones, it is dominated by the work of Doran (5), in whose monograph practically all that is known concerning these bones will be found, though there is a considerable literature dealing with the ossicles in man. In the Doran monograph the auditory ossicles of European beaver, *Castor fiber* Linn. are described (page 410) and figured (plate LX, fig. 12) though unfortunately the figures are too small to be of real value. As the ear bones of the Canadian beaver have not been described or figured, this paper constitutes the first contribution on this subject both to the living and to the fossil forms. By comparing with Doran, it will be seen that the ossicles of *C. fiber* differ as much from those of *C. canadensis* as both differ from *Castoroides ohioensis*, though there are marked similarities between all three.

EAR BONES OF CASTOR CANADENSIS CANADENSIS

Malleus.—The head of the malleus is large, occupying a trifle less than one half of the entire ossicle. From the anterior aspect it is distinctly globular and ovoid in shape, being markedly compressed. The facet for the articulation with the

incus occupies about three-quarters of the posterior face; it is single and simple, being a plain concaved surface. Above this facet the head of the malleus rises less than one-fifth of its entire length, and the upper lip of the facet is set at an angle of 33° with the main axis as the ossicle, the high point of this lip being external. In a position to correspond with this upper lip of the articular facet, but on the opposite (anterior) side, the head is pinched into a dull pointed projection, beneath which a thin, sharp ridge projects to the proximal end of the manubrium, passing along the neck. This ridge has an elaborate and very irregularly jagged margin. On one side of this ridge the head is hollowed out to form a shallow, more or less semicircular cup-like depression, the surface of which is rough and pitted. The neck is short and the vertical ridge above mentioned is prolonged into this region, where it disappears. The main axis of the manubrium, the long ventral process, is set at an angle of 132° with that of the head and neck, though the proximal end continues approximately along the axis of the head and neck. The obtuse angle therefore is formed by a bend in the manubrium itself, not by its articulation with the rest of the ossicle. The blade of the manubrium is greatly flattened and is very thin; at the proximal end it flares widely into a shoulder, the proximal lateral end of which merges with the neck. The distal angle of this shoulder is the *processus brevis*. In shape the blade is an elongated triangle with the distal, attenuated tip slightly curled posteriad. At the base of the shoulder and immediately beneath the neck is a low protuberance, the *processus muscularis*, and at the base of this process the manubrium is pierced by a minute but perfectly formed foramen passing completely through the bone. No mention is made of such a foramen in Doran's monograph, and what may be its significance is not at all clear. There is no evidence to indicate that it is not a perfectly normal foramen, and unfortunately I have no other specimen from *C. canadensis* with which to compare it, but the fact that a similar foramen is present in the same location in *Castoroides ohioensis* is significant. The malleus is 6.62 mm. long. The head is 3.2 mm. in length, by 2.65 mm. in width, and 1.70 mm. in thickness. The manubrium measures 3.15 mm. from the *processus brevis* to the ventral tip.

Incus.—The incus, the most conservative of the ossicles, is well formed, solid, and roughly triangular in body form. The surface for articulation with the malleus is only very slightly convex, and the edges of this face are well rounded and smooth. The *processus brevis* is distinctly short, curves dorsally, and is drawn out into a dull point. It rises at almost a right angle with the main axis of the incus. The ventral *processus longus* is much longer, and proceeds at an angle of 18° ventral to the main axis. While it tapers somewhat toward its distal extremity, it ends abruptly in a blunt, spatulate disc, the *os orbiculare* or Sylvian apophysis. In *Homo sapiens* this *os orbiculare* is known to be a separate bone which very early unites with the *processus longus* of the incus. Probably the same is true in the beaver, but in old specimens there is no evidence that it is anything but an epiphysis of the incus, as is also true in *Homo*. At a point just ventral to the base of the long process is a deep, narrow, rounded pit. At the outer margin of this pit the side of the process bears a small protuberance, above which the body of the incus shows a shallow depression, which gives one side of the triangular body a slightly concave outline. The greatest length of the incus, e.g. from the mallear articular surface to the tip of the Sylvian apophysis, is 4.10 mm.; similarly measured, the distance to the tip of the short process is 1.86 mm., while the vertical

distance between the tip of the short process and the tip of the apophysis is 2.35 mm.

Stapes.—The stapes is an exquisitely delicate little bone. The head, which articulates with the Sylvian apophysis of the incus, is only a trifle wider than the neck immediately beneath it, which is formed by the fusion of the crura, is widely elliptical and almost flat, being but slightly convex. The anterior crus is much more slender than the posterior, and arises from the base as a slender projection which widens uniformly to its union in the neck. The posterior crus is much heavier. It arises from a very wide articulation with the base, to narrow greatly half way to the neck, beyond which it widens again equally to join the anterior crus in forming the neck. It may be described as being shaped like an hour-glass. Hence the aperture between the crura is highly asymmetrical. The inner surface of the anterior crus is deeply grooved to form an open canal which continues forward through the neck. A similar groove starts from the base of the posterior crus, but is lost at the point where the bone becomes narrow, to begin again on the opposite surface when the bone starts to expand above this point, and continues to the neck where it ends in a deep pit which, however, does not unite with the canal of the anterior crus. Ventrally these canals unite to give the tympanic surface of the base a deeply cupped appearance, the cavity running under the ridge formed by the union of the bases of the crura. The crura are inserted in the base at a distance from its extremities, but each is set back the same distance. The base is somewhat reniform, and is wider beneath the anterior crus than at the opposite extremity, which is more pointed. However, the base is thicker beneath the posterior crus. The tympanic surface of the base has already been mentioned. The opposite surface, that which faces the inner ear in the *fenestra ovalis*, is more difficult to describe. The four corners (if this term may be applied to an ovoid surface) are flat. Median to these the surface sinks in slightly, to rise again in the center of the base as a median blunt mound which has a slightly roughened surface. The stapes is 1.90 mm. high, the vertical diameter of the aperture being 0.92 mm. The base is 0.32 mm. thick beneath the posterior crus, and 0.25 mm. thick beneath the anterior. The total length of the base is 2.05 mm., while the aperture between the base of the crura is 1.42 mm. The maximum width of the base, just beneath the anterior crus, is 1.10 mm.

EAR BONES OF CASTOROIDES OHIOENSIS

Malleus.—The malleus of the fossil beaver shows certain points of similarity to that of *C. canadensis*, and also some points of distinct difference. The head is much larger, more massive and more irregular in outline. It is distinctly more oval and less triangular in shape. The surface for the articulation of the incus is markedly saddle-shaped, having *two* very distinct facets, the upper of which is concave, the lower slightly convex. The upper facet is almost vertical to, the lower parallel with, the axis of the bone. The upper lip of the articular surface is set at an angle of 38° with the main (longitudinal) axis of the ossicle, the high point being external. Above this lip the head rises approximately one quarter of its total length, and the remaining portion of the articular surface is occupied by the facets. The ridge, which in *C. canadensis* passes from the head to the neck, is here very much more prominent. It starts on the very top of the head as a

slightly curled, narrow ridge. Passing toward the neck it becomes thinner and higher and terminates abruptly between the *processus brevis* and the *processus muscularis* of the manubrium. The neck is short and slender, being compressed. The shoulder of the manubrium is rather similar to that of *C. canadensis*, but the *processus muscularis* is more conspicuous and better developed, while the *processus brevis* shows a correspondingly lesser development. As in the case of the modern beaver, a deep, precipitate foramen pierces the manubrium at the base of the muscular process. Beneath the shoulder the blade becomes very thin, but unfortunately in our specimen is broken just below the muscular process. Indications are, however, that the two processes are very similar. The length of that portion of the malleus which we have is 5.21 mm., indicating a bone somewhat larger than in *C. canadensis*, for nearly the entire blade is missing. The head is 3.85 mm. long, by 3.11 mm. wide, and 2.30 mm. thick. The manubrium in 2.12 mm. across the *processus muscularis* and *processus brevis*.

Incus.—Since the malleus has two distinct articular surfaces, the incus also shows two articular surfaces, therein exhibiting the most striking difference with that of *C. canadensis*. The malleus literally wraps itself around two sides of the incus and forms a contact with most of the longitudinal face of the proximal surface. The anterior articular surface is slightly convex to fit into the concave surface of the malleus, the posterior articulation being concave for a similar reason. The *processus brevis* is short and conical, bluntly attenuated, and somewhat curved dorsally. The *processus longus* is relatively larger than in *C. canadensis*, and shows no tendency to taper toward its distal end. Except for the widening of the proximal end where it merges with the body, the long process is of equal diameter throughout its length. It terminates even more abruptly than in the modern beaver in the spatulate *os orbiculare* or Sylvian apophysis. The length from the tip of the body to the end of the apophysis is 4.16 mm.; to the end of the *processus brevis* 2.40 mm.

Stapes.—Although a trifle larger than in the modern beaver, the stapes of the fossil form is much more delicate. The head is widely oval and highly domed, and is separated from the neck by a distinct though narrow collar. It is proportionately larger and more prominent. The neck is much thinner, due to the fact that the crura do not flare as much in their union. The crura are of essentially the same thickness, and of the same thickness throughout, while the posterior crus is just a trifle shorter than the anterior. Thus the aperture between the crura is almost perfectly egg-shaped and symmetrical, which is in marked contrast with the condition in the modern beaver. The inner surface of each crus is deeply grooved, the canals thus formed continuing dorsally to where they unite in the neck and continue up into the head; ventrally they continue below the ridge formed by the union of the crura with the base, leaving the latter deeply cupped beneath a strong peripheral lip. The crura are inserted into the base at a distance from its extremities, but the posterior is placed decidedly nearer to that extremity than the anterior is to the anterior extremity. The base is very slightly reniform and but slightly convex along both axes. It is not of uniform thickness, being thicker beneath the posterior crus than beneath the anterior, the former portion being 0.40 mm. and the latter 0.26 mm. in thickness. The stapes is 2.65 mm. high, the crura are 0.18 mm. thick, and the base 2.25 mm. long by 1.22 mm. wide at the point of its greatest expanse.

For some time at least prior to 1904, the monotypic family Castoroididae was a taxonomic football. In their "Monograph of the Rodentia" Coues and Allen placed it in the superfamilly Hystricomorpha with the porcupines, guinea pigs and cavies, because of certain similarities in the tooth structure. This similarity lies in specialization along the same lines as found in *Dinomys*, *Amblyrhiza* and other Hystricine genera, but which is now recognized as being a case of parallelism. Teeth are too variable and too easily subject to modification to warrant their serious use as criterion for final determination of phylogenetic affinities; the skull must be the ultimate test. And the skull of *Castoroides* is as typically sciurine as is that of *Castor*. Hay, in his "Pleistocene Mammals of Iowa" places Castoroides in the superfamily Sciuromorpha with the squirrels and modern beavers, while Max Weber in "Die Säugethiere" (1904) goes still farther and places *Castoroides* in the family Castoridae, thus eliminating entirely the family Castoroididae. The position of the Castoroididae as now accepted is that of Miller and Gidley in their "Synopsis of Supergeneric Groups of Rodents" (1918), where it is considered as a perfectly good Sciurine family. It is of interest to note that a study of the auditory ossicles bears out this idea. In spite of certain conspicuous differences existing between the ear bones of *Castor canadensis canadensis* and *Castoroides ohioensis*, notably concerning the malleus and to some extent the stapes (the incus is the most conservative of the ear bones), the auditory ossicles of *Castoroides* resemble those of *Castor* much more closely than those of the porcupines, guinea pigs or cavies. The writer has had the opportunity of examining the ossicles of both the porcupine and the guinea pig, and finds both the figures and descriptions of these bones as given by Doran (5) to be correct. In the porcupine the head of the malleus projects prominently forward like a "Phrygian cap." In the guinea pig the head is still more produced, and vies successfully with the manubrium as a prominent lateral projection, giving the malleus the shape of a letter "L." In these representatives of the Hystricomorpha, furthermore, the malleus and incus are ankylosed, which is not the case in either of the Sciurine families Castoridae and Castoroididae. Since Doran has shown a very general resemblance between the ossicles of animals within the family at least, the evidence of the ear bones under discussion falls perfectly in line with the classification outlined by Miller and Gidley.

Anyone undertaking a study of the auditory ossicles will find them a subject of extreme interest, and the study of these bones in almost all of our North American mammals still awaits attention, for they have been sadly neglected.

SUMMARY

1. There is relatively very little difference in the size of the auditory ossicles of *Castor* and *Castoroides*, yet the skull of the former measures 124 mm., while the later measures 291 mm.

2. The malleus of *C. canadensis* has but one articular surface for the incus, while that of *C. ohioensis* has two such surfaces, and a corresponding difference exists in the case of the incus.

3. Attention is called to a prominent foramen at the base of the manubrium of the malleus, which is present in both species.

4. The ridge extending from the head of the base of the manubrium of the malleus is much more pronounced in *C. ohioensis*.

5. A marked difference exists in the posterior crus of the stapes, which in *C. canadensis* is "hour-glass" in shape, and lacks the open canal found in the anterior crus and in both crura of *C. ohioensis*. Because of this difference, the aperture between the crura is asymmetrical in *C. canadensis* and symmetrical in *C. ohioensis*.

6. The head of the stapes of *C. ohioensis* is much more prominent and domed, and the crura are inserted into the base equidistant from the extremities, both of which features are in contrast with the condition in *C. canadensis*.

7. Attention is called to the fact that, while the teeth of *Castoroides* show certain resemblances to those found in certain Hystricine families, the ear bones show a much greater affinity for certain Sciurine families, notably the Castoridae, with which, also, the skull of Castoroides closely conforms.

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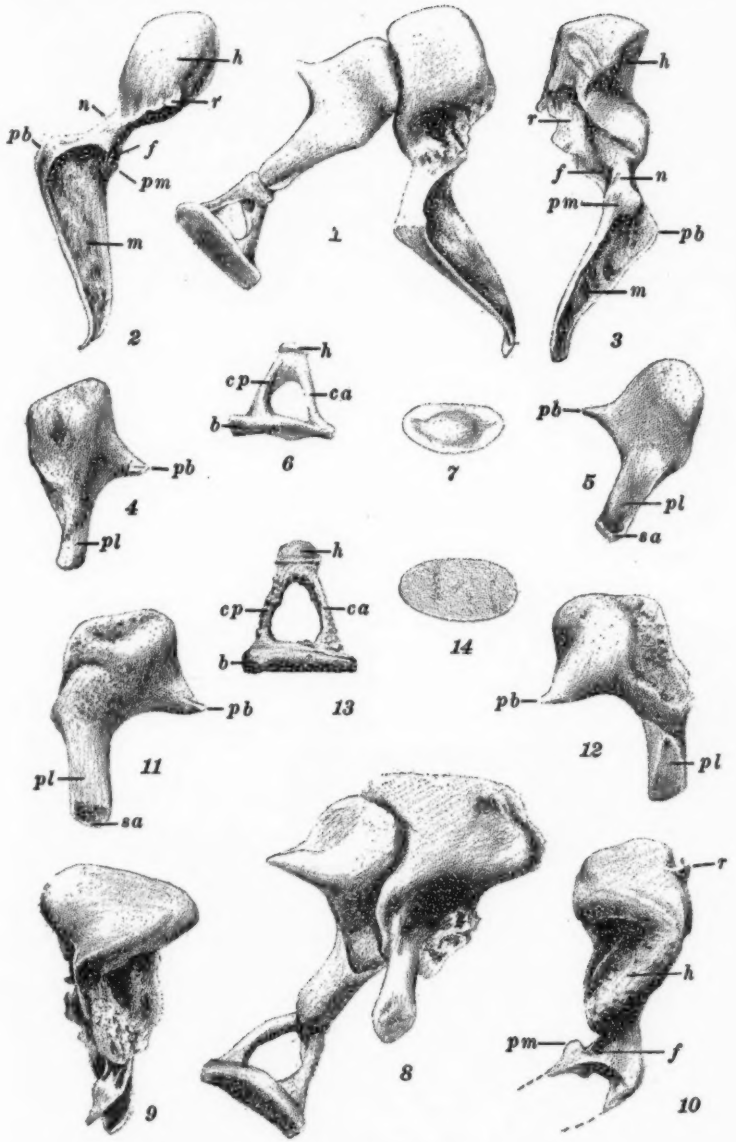

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EXPLANATION OF PLATE

Figs. 1–7. Auditory Ossicles of Castor canadensis canadensis; Right Ear

Fig. 1. Assemblage of the ossicles; external view.

Figs. 2, 3. Malleus.

Figs. 4, 5. Incus.

Fig. 6. Stapes.

Fig. 7. Base of stapes.

Figs. 8–14. Auditory Ossicles of Castoroides ohioensis; Right Ear

Fig. 8. Assemblage of the ossicles; external view.

Figs. 9, 10. Malleus.

Figs. 11, 12. Incus.

Fig. 13. Stapes.

Fig. 14. Base of stapes.

Abbreviations: *b*, base; *ca*, anterior crus; *cp*, posterior crus; *f*, foramen; *h*, head; *m*, manubrium; *n*, neck; *pb*, processus brevis; *pl*, processus longus; *pm*, processus muscularis; *r*, ridge; *sa*, Sylvian apophysis.

A NEW PLIOCENE HORSE FROM IDAHO

By James W. Gidley

[*Plate 18*]

Late in the summer of 1928, the U. S. National Museum received a few small lots of fossil bones from the Snake River Valley, Idaho, collected by Dr. Harold T. Stearns in connection with his work on ground-water resources. These and the reports sent in by Doctor Stearns gave such promise of a profitable collecting field that the Smithsonian Institution sent an expedition there the following summer (1929). This expedition obtained additional collections of considerable interest and value. By far the most important lot collected consisted of a quantity of well preserved fossil remains of an extinct species of horse belonging to the rare genus *Plesippus*. These specimens came from a fossil bone deposit in the vicinity of Hagerman, Idaho.

The credit of discovery of this deposit goes to Mr. Elmer Cook, a resident of Hagerman, Idaho, who reported it to Dr. Stearns. The Smithsonian party collected here a quantity of well preserved material all pertaining apparently to a single species of horse. This material includes several skulls and jaws and numerous bones of all parts of the skeleton, representing ages ranging from young colts to old adults of both sexes.

Plesippus

Characters of the Genus. This varied material admits a complete check-up on the proper generic reference of the species represented and shows it to be a direct intermediate stage between *Pliohippus* and *Equus*, as was noted by both Merriam and Matthew. The reference of the new species to *Plesippus* is indicated in the following features. Relatively large head that has the general proportions of *Equus* as compared with that of *Pliohippus* and other older genera of horses, although it still retains shallow but distinct facial pits; cheek teeth with relatively simple enamel folds and open cement lakes combined with general subequus development; relatively small hoofs; and the presence of vestigial metacarpal V and trapesium in the fore feet. Other characters noted in the Idaho material further distinguish the genus *Plesippus* from *Equus*. These are less procumbent position of both the incisor tooth series; relatively larger canines in the males; and occasionally vestigial canines in young females; presence in both sexes of small but functional

Upper—Plesippus shoshonensis Gidley. Lateral View of Skull and Lower Jaws. Cat. No. 11,986, U. S. N. M.; Male
Lower.—Plesippus shoshonensis Gidley. Palatal View of Skull. Cat. No. 11,989, U. S. N. M.; Female

upper first premolars;[1] more backward position of the orbits; and the relative shortness; greater angulation of the basioccipital region, resulting in a more overhanging position of the occiput than is seem in modern *Equus*.

The latter feature as well as the more nearly perpendicular position of the incisors, the relatively large head, and small hoofs are features observed in *Equus scotti* and the better known North American Pleistocene horses. This suggests that *Plesippus* as represented by the species at present known may have been directly ancestral to the North American species of *Equus* only, and that the living species of horses were derived from some as yet unknown branch of the *Plesippus* group. The characters that distinguish *Plesippus* from *Pliohippus* have been adequately given by Matthew[2] and need not be repeated here. The material from Idaho seems to represent a new species which is here described.

Plesippus shoshonensis new species

Type: A complete skull and other parts of the skeleton (No. 11, 986, U. S. Nat. Mus.). *Paratypes:* A quantity of material, representing individuals of both sexes varying in age from colts to old adults.

Type locality: Near Hagerman, Idaho.

Diagnosis: Size about that of *Equus niobrarensis* or of a domestic horse of about fourteen or fifteen hands height; skull with shallow but well defined facial pits; muzzle and facial region long with orbit set well back; nasals relatively long and slender; basicranial region shorter and more bent downward than in *Equus;* cheek teeth long as in *Equus*, but in general more curved than is usual in the latter, and less curved than in *Pliohippus;* cement lakes in upper cheek teeth somewhat more open and with less elaborate enamel folding than is usual in *Equus;* protocones much more lengthened anteroposteriorly than in *Pliohippus* but less so than the average in *Equus;* lingual wall of protocone completely flattened, in some specimens definitely bent inward and presenting the longitudinal groove so commonly found in *Equus*.

This species may be distinguished from *P. simplicidens* by the seemingly more distinct invagination of the facial pits; the more posterior position of the orbits; and from both *P. simplicidens* and *P. proversus*, by the generally more advanced or *Equus*-like development of the cheek teeth as indicated by the greater lengthening and greater curvature of the upper molars and by the generally more transversely flattened and grooved protocones.

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[1] These seem to have a tendency to shed early and may not appear in very old individuals.

[2] Amer. Mus. Nat. Hist. Novitates, No. 131, 1925, and Quart. Review of Biol., Vol. 1, 1926, pp. 162–164.

Skull measurements of two individuals

	♂ No. 11,986	♀ No. 11,988
	mm.	mm.
Greatest length, incisor border to occipital crest	625	595
Length incisive border to condylar notch	560	520
Length tip of nasals to occipital crest	560	522
Length of lower jaws, incisor border to condyles	525	495
Length of upper cheek tooth series	188	190
Length of diastema between I^3 and p^1	120	104

Tooth measurements of three individuals

		♀ No. 11,989 Young (?4 years)	♂ No. 11,986	♀ No. 11,988 (8 or 9 years)
Canine	Anteroposterior diameter	4.5	15.5	None
	Transverse diameter	3.5	12.5	None
p^1	Anteroposterior diameter	15.5	14	11.1
	Transverse diameter	8.5	12	8.5
p^2	Anteroposterior diameter	41.7	41	41.5
	Transverse diameter	29	28.3	27.5
p^3	Anteroposterior diameter	34.5	30.5	30.3
	Transverse diameter	29.3	30.5	30.3
p^4	Anteroposterior diameter	32	29.3	29.1
	Transverse diameter	29	30.5	29.1
m^1	Anteroposterior diameter	28.2	25	25
	Transverse diameter	28.5	28.2	28.5
m^2	Anteroposterior diameter	31	28	28.5
	Transverse diameter	28.5	29.2	27.7
m^3	Anteroposterior diameter	25.5	33	30.5
	Transverse diameter	19	28	24.5

COMPARISON WITH EQUUS IDAHOENSIS MERRIAM[3]

In 1918 Merriam described a new species, *Equus idahoensis*, based on a single worn upper premolar and two referred specimens, an upper molar and a lower premolar, from near Froman Ferry on the Snake River in the extreme western part of

[3] Merriam, J. C., Bull. Univ. California, vol. 10, 1918, pp. 527–530, figs. 3–5.

the state and about 150 miles northwest of Hagerman. Since this fragmentary material is purported to be from the Idaho formation and therefore similar in age to the bed at the Hagerman locality, it should be critically compared with the Hagerman material.

Such comparison as can be made from Merriam's description and figure shows that the teeth described by him first of all belong to a definitely larger species of horse, and, more important still, they show certain true *Equus* characters pointed out by Merriam which seem to establish their proper reference to that genus. While they have a general resemblance to corresponding teeth of *Plesippus shoshonensis* the considerably greater anterior projection of the anterior limb of the protocone in Merriam's type specimen and the more constricted cement lake with its more elaborately folded enamel borders, seen in the referred molar, are characters which seem to mark the two species here compared as generically distinct.

BIRTH OF SECOND CHIMPANZEE IN THE PHILADELPHIA ZOÖLOGICAL GARDEN

By C. Emerson Brown

[*Plate 19*]

The birth of the first chimpanzee, a male, in the Philadelphia Zoo occurred October 1, 1928. The youngster was not particularly lively, and the mother, while somewhat attentive to it, would not nurse it. Therefore, it was necessary for us to remove it from her cage and rear it by hand. A full and complete account of this birth was recorded by Dr. Herbert Fox, Pathologist of the Laboratory of Comparative Pathology, and published in the Journal of Mammalogy, Vol. X, No. 1 of February, 1929.

The second chimpanzee, born of the same parents, a female, arrived here April 26, 1930 at 8:05 a.m. It differed from the first in its actions, and in a number of interesting facts noticed. The first baby was entirely unexpected, especially as the parents, "Marianne" and "Sultan" were only approximately seven and one half years old. The second arrival was expected and the necessary arrangements were made. Marianne and Sultan were separated about two months before the expected time of birth, which, I believe, gave the mother more time to rest. Consequently, she appeared less nervous and excitable at the time of birth, and her disposition seemed to change from a wild dangerous animal to one quiet, affectionate and friendly.

On April 19th Marianne appeared to be exceedingly thirsty, more so than ever before, drinking at least double the quantity of water usually given her. The vagina appeared to be somewhat enlarged at this time, and on April 24th a slight whitish discharge was noticed. On April 26th, the vagina had opened more than at any previous time, and Marianne took the position of standing on "all fours" with her head dropped downward and both head and shoulders lower than her hips. She made no noise of any kind and showed no sign of pain. Sultan, the male in the next cage, paced the floor nervously and attempted to peer through the cracks of the board between the cages. At 7:55 a.m. on the morning of April 26th, she came down from the top of her den and made a thick bed of hay on the floor in the corner of her cage. Twice only did she utter a sound, and then it resembled a low grunt of pain. At 8:05 a.m. the young one was born without trouble of any kind. Marianne showed no excitement nor any visible sign of pain. She immediately went about cleaning it up, licking it all over. She also licked all the blood off the afterbirth, but made no attempt to eat it or sever the cord. She left the baby lying on its back from the time of birth until four o'clock in the afternoon when the keeper reached his arm through the bars in an effort to take hold of the young one. She immediately picked it up, a hind leg in each hand, holding it head down as though she were about to put its legs around her neck. Ten minutes she held it in this position and then laid it gently down again. The keeper gave her a cup of water and while holding the cup in one hand she reached down, picked the baby up, and held it in a natural position in her arm. She continued to hold the baby in this manner until about 1:30 a.m. April 27th when she raised it higher until it found the nipple of her right breast and nursed for the first time. The left breast was not touched until 10:30 a.m. Although she made no attempt at all to nurse her first baby, she handled the second as if she were perfectly used to it.

The afterbirth remained attached to the young one until 3:30 p.m. of April 27th. At 11 a.m. of this day, Marianne jumped onto the top of her den, carrying the baby in one arm and carefully holding the placenta in the other hand so that the weight of it would not be felt by the baby. Sitting quietly down, she appeared to be soaking the cord with her lips, and then picked tiny pieces from it with her fingers until it was severed. This occurred at 3:30 p. m. and it was immediately removed by the keeper. She did not offer to eat it or to retain it when it was being taken out. We have no actual dates for the gestation period, but as near as it can be figured, reckon it to be about eight months.

MOTHER AND BABY CHIMPANZEE. A POSITION FREQUENTLY ASSUMED BY MOTHER FOR SEVERAL DAYS AFTER BIRTH OF HER BABY

The second baby appears large and more healthy looking than the first. Its body is sparsely covered with fine hair, but the head has a thick covering of long black hair. The skin of the baby is dark gray in color, whereas that of the mother is a light buff, nearly resembling the skin of a human in such places as under the arms, breast, etc.

For several days after the birth of her baby, Marianne seemed to be quite exhausted; her favorite position was lying flat on her back, head on the floor, and her baby face down lying across her breast or abdomen. On Tuesday, May 9th, while lying in this position, Marianne was seen gently rubbing the baby around the anus. Within a short time a very large, loose stool appeared, the first the keeper had noticed. This was entirely cleaned away by the mother who gently wiped both herself and baby with hay.

Marianne took her baby out of doors for the first time on May 4th, and it received a good sun bath.

On May 7th, the baby talked for the first time in true chimpanzee language. It appeared to take more notice of things and would follow a moving object around with its eyes, now bright and wide open.

At the time of writing the baby seems to be in excellent health and is nursing ten to twelve times daily, a very little at a time. While the breasts of the mother have not visibly enlarged, she seems to have plenty of milk.

One noticeably remarkable point in Marianne was the decided change in her temperament. She has always been a rather wild, cross and surly animal and could be approached by no one but her keeper. Since the birth of her baby, she is calm, quiet and even affectionate. The keeper opens her door and keeps it open while he pets and plays with her. She will even permit him to pet her baby. Sultan, the father, in the next cage where he can see his daughter but do no harm, rages, dances and yells but Marianne seems not to mind him at all, but attends continually to her baby. There is no doubt in my mind that in the case of expected births of the anthropoids, the male should be entirely separated from the female at least two months before the event takes place. The fact that we were unaware of the condition of Marianne the first time and the two were not separated, I believe, had some effect upon her failure to take proper care of her first offspring.

NOTES ON THE MAMMALS OF BREATHITT COUNTY, KENTUCKY

By W. J. Hamilton, Jr.

During the summer of 1925, I was stationed at the Zoölogical Field Laboratory of the University of Kentucky, at Quicksand, Breathitt County, Kentucky. A study of the mammals was undertaken from June 15 to July 24.

Breathitt County is in the eastern part of the state. The county is largely mountainous, consisting of a maturely dissected plateau, well forested. The soil, generally speaking, is poor and thin, preventing agricultural pursuits to any degree, and leaving the country rugged and unsettled. There are no large caves in the region where collecting was done.

Some of the more dominant trees and shrubs are listed. On the ridges: *Pinus rigida*, *Quercus montana*, *Castanea dentata*, *Quercus coccinea*, *Quercus alba*, *Fagus grandifolia* and *Cornus florida* appear in the order named. On the slope of the ridges: *Tsuga canadensis*, *Morus rubra*, *Hicoria*, *Betula*, *Liriodendron* and *Magnolia* are met. The cliff country is covered for the most with *Rhus radicans* and *Kalmia latifolia*. In the cool hollows, *Morus*, *Magnolia*, and *Ostrya virginiana* are found, while in the open fields *Asimina triloba*, *Gleditsia triacanthos*, *Cercis canadensis* and *Ulmus americana* grow. The river bottoms, characterized by slow-moving sandy-bottomed streams, are shaded by *Salix nigra*, *Populus deltoides*, *Betula*, *Liriodendron*, *Fraxinus*, and *Quercus bicolor*.

Most of the mammals were secured from the vicinity of Quicksand, the bulk of the material coming from the region about the junction of the south fork of the Kentucky River and Quicksand Creek. The help of the natives was enlisted, and many specimens were procured in this manner.

LIST OF SPECIES

Didelphis virginiana virginiana.—Opossum. The opossum was everywhere abundant, and hardly a day passed when the curious tracks were not seen in the hollows. The natives believe this animal to be very destructive to poultry, and wage continual warfare against it. They do not speak highly of its flesh. A quarter-grown male was trapped by a boy during midday. The trap was baited with corn.

Scalopus aquaticus machrinus.—Prairie Mole. This species is apparently the only mole of the region. Many are said to be killed during the spring-plowing and

occasionally one is upturned while the farmer is hoeing. All efforts to collect a specimen were without avail. The fresh ridges were particularly numerous after rains, and every potato patch had its tunnels at such a time.

Blarina brevicauda carolinensis.—Short-tailed Shrew. While only two specimens of this shrew were secured, it is unquestionably common on the ridges. I attribute my lack of success in catching these shrews to the ants. Formicids were a source of considerable annoyance at all times, eating the bait from many of the traps before a small mammal could enter them. Invariably the trapped mammals had fallen a victim to ants before I could reach them and the skin of the face and eyes were gone from many. The average measurements of two adult males are: Length, 107; tail, 27; hind foot, 13. The stomachs contained finely chewed insect remains.

Myotis lucifugus lucifugus.—Little Brown Bat. This was one of the commonest bats of the region, eight specimens in all being taken. The specimens ranged very widely in color, from very light sepia to a shade almost approaching black in some instances. One pied specimen was largely cream colored. All the females gave evidence of nursing, the mammae being greatly enlarged and the lacteal glands surrounded by large masses of fat. These bats appear to be commoner about the towns than in the country. One large colony was found to be inhabiting the church in Jackson. Every night, shortly after 7 p.m., they came out in a steady stream, and I estimated the number at close to three thousand. Several inhabitants, residing near the church, speak of a pure white bat among these. The average measurements of three adult males are: Length, 87; tail, 40; hind foot, 8; forearm, 36; tragus, 6. Five adult females measure: Length, 87; tail, 38.5; hind foot, 7.5; forearm, 37; tragus, 7.

Pipistrellus subflavus subflavus.—Pipistrelle. This was easily the most abundant bat of the Quicksand region. Its small size, distinctly tricolored fur and general yellowish color are unmistakable characters. Pipistrelles were seen usually a few minutes after 7 p.m. Most of the specimens procured were shot fifteen to twenty minutes after they first appeared, and invariably the stomachs would be greatly distended with small dipterous and coleopterous remains. This might imply that bats do not remain on the wing throughout the night, but make an early evening flight, then perhaps another toward midnight or early morning. All the males had enlarged testes. A female taken on June 26 contained two embryos, one in each horn of the uterus. They measured, from crown to rump, 14 mm.

Exciting sport was had collecting bats. Usually three or four of the local inhabitants, with several onlookers, would line up about dusk on a bridge spanning the Kentucky River, narrow and shallow at that point, and wait for bats. They knew I wanted bats; for what they did not care, so long as a valid excuse to shoot was furnished. There were more misses than hits, but every so often a small ball of fur would float to the river below. It was my duty to wade out and retrieve the animal.

Male and female show little variation in size. The average measurements for six are: Length, 80; tail, 38; hind foot, 8; forearm, 33.

Eptesicus fuscus fuscus.—Big Brown Bat. While only two bats of this species were procured, they were abundant at all times. This was the bat most frequently encountered in houses, both specimens being obtained in such a habitat.

The average measurements of two males are: Length, 117; tail, 43; hind foot, 10; forearm, 48; tragus, 7.5. Both had greatly enlarged testes.

Lasiurus borealis borealis.—Red Bat. The red bat was extremely abundant, and was seen every night. It was the first species to take wing in the evening and was observed on several occasions flying about in the full glare of the afternoon sun. One specimen was found hanging from a standing corn stalk in an open field during the middle of the day.

Nycticeius humeralis.—Rafinesque's Bat. This small bat appears rather uncommon, and I was fortunate to collect a single adult male. It measures: Length, 88; tail, 36; hind foot, 7.5.

Corynorhinus rafinesquii rafinesquii.—Big-eared Bat. On July 8, a boy brought into the laboratory a single specimen of this bat. It was stunned, and bloody in one ear. The specimen was determined by G. G. Goodwin of the American Museum of Natural History, and as that museum was without a specimen of this bat at the time, I deposited it with them. It was an adult male and measures: Length, 84; tail, 42; hind foot, 12; forearm, 40; ear from crown, 29; tragus,12; wing spread, 260.

Vulpes fulva fulva.—Red Fox. The red fox was everywhere abundant, and a source of considerable annoyance to those who kept poultry. My only actual record of the species, however, was the skull of one seen near Buckhorn.

Urocyon cinereoargenteus cinereoargenteus.—Gray Fox. This fox was even more abundant than the preceding, from all accounts. A portion of the skin of one was seen tacked to a mountain dwelling. The tracks of a fox, probably of this species, were observed in the loose dust about one of the cliffs near Buckhorn.

Procyon lotor lotor.—Raccoon. Coons were not very abundant about the Quicksand region, but their tracks along Buckhorn Creek were much in evidence. A large number are said to be taken each winter for the fur.

Mustela noveboracensis.—New York Weasel. A specimen of this weasel was shot early in June by a farmer, who showed me the remains in a dry creek bed behind his cabin. Several natives tell me of seeing this species in winter near Smith Branch, none being white. It seems not improbable that they do become white, as the winters in these parts are often cold, with some snow. The subspecies that occurs here is probably *notia*.

Several people spoke of a smaller weasel, which has a very short tail. This is possibly *Mustela allegheniensis*.

Mustela vison mink.—Mink. The only actual record of this animal rests on a skull that was found in Rose Branch. The mink is probably not uncommon, as

tracks, apparently of this species were seen not infrequently along Troublesome and Buckhorn creeks.

Mephitis nigra—Skunk. Whether this is typical *nigra*, or intermediate between this and the southern *elongata*, I can not say. A few men who trap in the region report skunks common. One I saw had been killed by a dog, but when seen it was past recovery as a museum specimen.

Lynx rufus rufus.—Bobcat. No specimens of this cat were secured. The natives appear quite familiar with it, and every winter a specimen or two is taken. It probably occurs in numbers in the wilder parts of the county.

Peromyscus leucopus noveboracensis.—Deer Mouse. This mouse was the most abundant mammal of the woods, and over twenty specimens were secured. These all average somewhat paler than New York specimens. Four of the mice taken were suffering from large bot fly larvae situated in the inguinal region. In one instance the larva measured 11 mm. A nest with five naked young was found in a deserted cabin on July 5.

Average measurements of eight adults, both male and female, are: Length, 172; tail, 75; hind foot, 21. Fleas of the genus *Ceratophyllus* were abundant on all the mice.

Neotoma pennsylvanica.—Wood Rat. The "blue rats" were not uncommon in cliffs throughout the county. Many must have been killed by forest fires, which at times are quite severe. On several occasions large masses of sticks, leaves, corncobs, bones and fungi were found piled in the rats' quarters. Natives tell of seeing these rats "hit whar as big as a cat" come down to the creeks to drink at night, and they are credited with killing young chicks.

Two specimens were secured in Fallen Rock Branch and one was observed in the daytime by Dr. Sherman C. Bishop. These were typical *pennsylvanica*, agreeing in every way with specimens from New York and Pennsylvania.

Pitymys pinetorum auricularis.—Pine Mouse. This subterranean mouse was common on the hillsides and pasturelands. They are said to destroy freshly planted corn. This species appears to replace entirely *Microtus pennsylvanicus*, as not a single meadow mouse was taken in the six weeks of trapping. That *Microtus* even occurs in this region appears doubtful, as the telltale signs of this mouse would in all probability have been observed, even in a superficial survey.

The pine mouse was rather difficult to trap because of its underground habits. One adult male, taken in a *Scalopus* tunnel, measures: Length, 125; tail, 15; hind foot, 16. A large warble was located just beneath the skin on the rump, and numerous fleas were present.

Ondatra zibethica zibethica.—Muskrat. The muskrat was locally common along the river bottoms, more particularly where muddy bottoms were present. On July 19 I watched a third-grown young one swimming along a creek near Buckhorn, in midday. Tracks were occasionally seen along the river bottoms, and were especially abundant about the South Fork of the Kentucky River above Quicksand.

Zapus hudsonius.—Jumping Mouse. A single specimen was observed in a small clearing grown up to sedge a mile east of Jackson. None was secured.

Sciurus carolinensis carolinensis.—Gray Squirrel. The gray squirrel was found abundantly in the heavily wooded parts. During early July, when the mulberries ripen in the hollows, the squirrels troop down to feed on these delicious fruits. Most of those killed are shot by hunters at this time. One man credits himself with nineteen in one morning, while another I saw had a string of seven. This probably accounts, in large measure, for their absence in many localities where conditions appear favorable. An adult male measures: Length, 420; tail, 210; hind foot, 66.

Sciurus niger rufiventer.—Fox Squirrel. Apparently very rare except in the heavily wooded parts where they are not much molested. Several natives speak of seeing "big red squirrels," and not a few tell of shooting this species in recent years. Mr. Barnet, who lives at the head of Smith Branch, has the skin of one.

Tamias striatus striatus.—Chipmunk. Very abundant in the Quicksand region and causes farmers much concern. It will pull up corn nearly as fast as it is planted and all efforts to resist its depredations are wasted. Usually a dog is kept in the field while the men are hoeing, and when a chipmunk is sighted the dog is set to work to scare it out. Usually the chipmunk goes free.

This is unquestionably *striatus*. Howell lists *fisheri* as occurring in this region. When the specimen was compared with these two subspecies, it was found to belong to the former race.

I secured only one specimen, an adult male, the cheek pouches of which contained three unripe blackberries, large seeds, some fungi and a small snail. It measures: Length, 229; tail, 78; hind foot, 33.

Marmota monax monax.—Woodchuck. This species was fairly well represented in all parts of the county, with the exception of the river bottom and the heavily wooded portions. Several specimens, killed by dogs, were examined. One had the stomach nearly filled with roundworms. The groundhog is considered a great delicacy among some of the mountain people, the young ones being preferred.

Glaucomys volans volans.—Flying Squirrel. Only a single specimen was observed. It had made its home in a dead oak stub. The nest of shredded bark was in a deserted flicker's hole. When I rapped on the stub, the little animal ran out, peered at me a moment, then glided thirty yards or more to a chestnut oak on the side of the mountain. When pursued, it made off in a series of graceful glides, and was soon lost to view.

Sylvilagus floridanus mearnsii.—Cottontail. This rabbit was very abundant during my stay in the region. Many young were captured alive by boys and brought into the laboratory.

One specimen was found dead in a shaly crevass by the side of the road. The brain and part of the viscera had been eaten. Thinking it to be the work of an opossum or weasel, I saved what I could of the rabbit and used the rest for bait. The following day the trap held a house cat.

INTRODUCED SPECIES

Both the Norway rat (*Rattus norvegicus*) and the house mouse (*Mus musculus*) were extremely abundant about dwellings. A large black snake, the stomach of which I examined, contained a large rat.

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GENERAL NOTES

A NEW NAME FOR MARMOSA MUSCULA SHAMEL

In describing the new species *Marmosa muscula*, Journ. Washington Acad. Sciences, vol. 20, no. 5, pp. 83–84, March 4, 1930, I overlooked the fact that Cabanis applied the name *Didelphis musculus* to a species of *Marmosa* in 1848 (Schomburgk, Reisen in British-Guiana, vol. 3, p. 778, 1848). See Trouessart, Catal. Mamm. viv. foss., p. 1239, 1899. It is therefore necessary to rename the Argentinian animal, and I would propose to call it *Marmosa formosa*.—H. H. SHAMEL, *U. S. National Museum, Washington, D. C.*

A NOTE ON THE DUSKY SHREW IN CAPTIVITY

The temperament of the dusky shrew in captivity has been so universally reported as cantankerous and unsociable, that it is a pleasure to report some observations to the contrary. Merriam's classic experience with *Sorex personatus* (= *cinereus*) (Mamm. Adirondack Region, p. 174, 1884), when three of these shrews were confined together, two of which immediately attacked and devoured one, and the stronger of the remaining two killed and ate the weaker, all in the space of a few hours, has been accepted as a key to the savageness of their dispositions.

On August 8th, 1927, I received from Mr. R. J. Niedrach of this Museum two live specimens, a male and female, of *Sorex obscurus obscurus* (Merriam) which he had trapped in pit-falls along the meadows of upper Clear Creek, Clear Creek Co., Colorado.

For the few days they had been in his possession before bringing them to Denver, Mr. Niedrach had fed the shrews on meat fragments, cheese and watermelon rind. On their arrival at the Museum they were established in a wire cage, 12 x 12 x 18 inches, and provided with a nest box, water, and a more varied diet. The two little animals lived in perfect harmony except for occasional disputes involving much twitching of noses and high, almost inaudible squeakings. When awake they were ceaselessly active, forever exploring their confines or nosing about for food.

In sleeping the two lay curled snugly, side by side, each one's nose at the other's tail. Their appetites were large, indeed almost insatiable and they readily consumed a variety of insects and other animal and some vegetable food. The two little creatures unfortunately did not live long and were found dead in their nest at the conclusion of a week-end, when the food provided for them had proven in-

adequate and what was doubtless more important, their water too had been exhausted. The amity with which they lived together may be traceable to the fact that they were a pair. Had both been males, their attitude toward each other would no doubt have been vastly different.

While no detailed account of their food was kept, the following notes for a sample twenty-four hour period will reveal something of its scope.

August 11, 1927, 9:30 a.m. Have just given the shrews eight good sized live grasshoppers. They were attacked savagely and by 10:30 all were eaten when four more hoppers were placed in the cage. In attacking the hoppers the shrews seemed guided more by smell than sight; when one was located they pounced savagely for the head and if successful in their leap they bit and chewed savagely about the head and neck. As the grasshoppers were large, some in fact almost as big as the shrews, not a few exciting tussels ensued, but perseverence on the part of the aggressor prevailed in time, and the victim was subdued. Eating was usually begun at the head and all but the hard chitinous parts of the legs and other parts was consumed. At other times particles of food were held firmly against the floor with the fore-feet, and the lower incisors were employed to hook into and tear them apart.

11:30 a.m. Two more average size grasshoppers were given the shrews. The pair of them joined forces in killing one, experiencing some difficulty in mastering it. They then proceeded to eat it side by side in perfect harmony. The other hopper met a similar fate.

11:45 a.m. A grand-daddy long legs spider was killed and eaten by one of the shrews. A dead inch worm was also sampled.

1:00 p.m. The shrews killed and ate three more grasshoppers. A stink bug put in at the same time was investigated, but on defending itself, it was left alone. They also drank a good deal and splashed about in their shallow dish of water.

2:00 p.m. The shrews have been quiet for some time and are now asleep, cuddled close to each other, their heads in opposite directions.

2:30 p.m. A grasshopper aroused but little interest, the shrews seem tired and full.

3:30 p.m. The shrews made short work of a big grasshopper, joining forces in killing and eating it.

4:30 p.m. Have just given the shrews rations to last the night. Eight grasshoppers, a stink bug, two ground beetles, three horse flies and a bit of watermelon rind.

August 12, 1927, 8:30 a.m. During the night the shrews cleaned up all the food provided for them, including the stink bug and watermelon rind. Bits of bacon and six earth worms provided for them this morning were both eaten, though they displayed no particular liking for either.—FREDERIC W. MILLER, *Colorado Museum of Natural History, Denver, Colo.*

LEAST WEASEL IN PENNSYLVANIA

On January 2, 1930, Amos Miller, a farmer, of Bedford Valley, Pa., dug out a den of the Alleghany Least Weasel, *Mustela allegheniensis*, and found a mother and three young over half her own size,—just about the average size of those caught in August, and with the silky, shining fur and peculiar flesh side of pelt characteristic of the young usually taken at that season. The whole family was sent in for

bounty, and a game protector made investigation on the ground, thoroughly verifying date of kill.

October 30, 1926, Vernon Coleman, Central City, Somerset Co., Pa., killed a very young Least Weasel.

October 19, 1928, Walter Dennis, of Linesville, Crawford Co., Pa., killed a very young Least Weasel.

January 25, 1928, Steve Karode, of near Burgettstown, Washington Co., Pa., dug out a den containing a mother Least Weasel and four young. It is doubtful whether all the young yet had their eyes open.

February 8, 1929, Donald Fox, Davistown, Green Co., killed an adult and her six young, almost full grown.

Whether this means a second litter in at least some cases, or is to be explained in some other way, is for discussion. The den first referred to showed remains of mice only, and not a hint of a feather,—not a surprise, of course, to those who already knew the Least Weasel as far more beneficial than destructive.

It has been reported that in Pennsylvania no Least Weasel had yet been found in white winter pelage. The following records are therefore interesting: On January 15, 1928, Mr. Jean Alden secured one in pure white pelage at Keating Summit, Potter Co., Pa. On January 16, 1928, Mr. Austin S. Diehl, of Bedford, Bedford Co., Pa., secured a pure white one. On February 21, 1929, Mr. J. S. Tremmel, of Florence, Washington Co., Pa., took a specimen of Least Weasel that was pure white except for a dusky-tipped tail.

And nearly a dozen pure white ones have been sent in to the Pennsylvania Game Commission during the winter of 1929 and 1930, besides three or four sent in early in the fall of 1929 that were changing from brown to white.—Thos. E. Winecoff, *Pennsylvania Game Commission, Harrisburg, Pa.*

THE DISTRIBUTION OF FOXES IN PENNSYLVANIA

For a number of years the writer has been interested in the mammals of the state of Pennsylvania and their distribution within the confines of the Commonwealth and has published several papers on the subject.[1] There seems to be a definite relationship between geographical distribution and habits. For instance, the two foxes native to the state, the red fox (*Vulpes fulva*), and the gray fox (*Urocyon cinereoargenteus cinereoargenteus*), show an interesting relation in this respect.

From data in the writer's personal records and from information supplied by the Pennsylvania Game Commission the red fox is shown to be distinctly northern in its range while the gray fox is more abundant in southern regions. In the northern tier of counties, comprising Erie, Warren, McKean, Potter, Tioga, Bradford, Susquehanna and Wayne, from June first 1924 to May 31, 1929, bounties were paid on 8703 red foxes and 3960 gray foxes in these counties during the same period. In the southern tier of counties including Greene, Fayette, Bedford, Somerset, Franklin, Adams, York, Lancaster and Chester, during the above period, bounties were paid on 8235 gray foxes and only 2087 red foxes.

[1] The Mammals of Pennsylvania, Univ. of Pittsburgh Press—1928; The Mammalian Fauna of Pennsylvania, Annals of The Carnegie Museum, Vol. XIX, no. 4, 1930.

These figures indicate a two to one ratio of red foxes in the northern counties and a four to one ratio of gray foxes in the southern counties. However, these numbers do not indicate the true distribution of the foxes in the state. A study of all available data shows that the gray fox is almost exclusively confined to the mountainous districts and even in the mountainous northern counties, the gray fox is the more abundant. On the other hand, in Greene county, one of the southern tier, the bounty lists indicate a great preponderance of red foxes in the ratio of eleven to one, while in Fayette, a mountainous county which adjoins Greene, the gray fox outnumbers the red fox, in the lists, eight to one.

While the general averages indicate that the gray fox prefers a secluded, woodland habitat, they also show a preference of the red fox for agricultural and pastoral districts.

That the foxes are far from being exterminated in Pennsylvania is shown by the bounties paid in the five year period already referred to. During this time a total of 39099 bounties were paid on gray foxes and 23558 for red foxes. The figures seem to show a greater abundance of gray foxes but it may be that the sparsely populated mountainous districts in which the gray fox chiefly lives, offer a security which the thickly populated, open districts which the red fox selects, do not present. The secluded habitats of the gray fox are less frequently invaded than those of the red fox and while the latter produces a greater number of offspring, it lives in much more dangerous districts, for, in addition to living in regions where hiding places are scarce there is the added danger of dogs which are more numerous in thickly settled districts. The continued abundance of the red fox in its more precarious habitats indicate a keener intelligence than that possessed by its relative.—Samuel H. Williams, *University of Pittsburgh, Pittsburgh, Pa.*

A THIRD RECORD FOR THE ALASKA FUR SEAL ON THE OREGON COAST

During December, 1929, (about the middle of the month), Mr. Sam Smith of Southbeach, Lincoln County, Oregon, found a dead Alaska Fur Seal (*Callorhinus alascanus*) on the beach at the mouth of Beaver Creek near his home, which is about six miles south of Newport. The specimen was a female and was brought to me for identification by Mr. J. W. Wagner on March 5, 1930.

The occurrence of this species on the mainland is so unusual that it is well worth recording.—Stanley G. Jewett, *Portland, Oregon.*

HOW A CHIPMUNK CARRIED HER YOUNG

Within the past few years a number of papers, (Snyder, 1923, Lang, 1925, Hatt, 1927 and Grange, 1928) have appeared in the Journal of Mammalogy dealing with the methods employed by various squirrels in carrying their young. However, in regard to the method whereby chipmunks carry their young, scientific literature seems to be silent.

On June 17, 1929, while lunching a few hundred feet down on Bright Angel Trail on the south rim of the Colorado River in the Grand Canyon National Park, Arizona, we observed an adult female chipmunk (*Eutamias dorsalis dorsalis*) moving about below us. She soon disappeared into a small rock slide about ten feet immediately below us. After a short stay she reappeared, running out onto a small rock where she stopped for a few moments. In her mouth was a hairy,

half-grown young chipmunk. The young one was clinging to the mother in a manner similar to that described for squirrels in the above mentioned papers; viz.; held belly-side up in the mother's mouth, with its tail, hind legs and fore paws curled about the neck of the mother. The adult chipmunk stopped just long enough for us to get a good look at her and her charge and then scurried off out of sight into the brush. We had evidently seen her transport the last of her youngsters to a new nesting place for, although we waited for some time, she did not appear again.—Arthur Svihla and Ruth Dowell Svihla, *University Museums, Ann Arbor, Mich.*

AN UNUSUAL CHIPMUNK NEST

While working near the Canadian border in Cook County, Minnesota, during the summer of 1929 I observed what seemed an unusual location for a chipmunk's nest. About the middle of July I noticed that a pair of chipmunks, *Eutamias minimus jacksoni* Howell, were spending most of their time in or near a black spruce, *Picea mariana*, in front of my tent. I then found that they had their nest, which appeared to be made of grass, in this tree about eighteen feet above the ground. The tree itself was about twenty-five feet tall and had a very slender and dense crown. The lowest branches were about five feet from the ground.

A few days later I saw the mother bring one of her babies down to the ground. It was about one-third grown and quite active. She was apparently trying to teach it to eat some bread scraps that I had thrown out for her but the little fellow did not seem to understand and would simply follow her around. When I attempted to get a snapshot of them she became alarmed and picked the little one up by the scruf of its neck and carried it back to the tree. It then followed its mother back to the nest.

There were three of these young chipmunks and they played down and up the trunk of the tree but I did not see them venture below the lower branches for several days after I saw the first one. They later became quite tame and stayed around my camp for the rest of the summer, although I do not think that they used the nest in the tree after they had become accustomed to being on the ground. Leslie W. Orr, *Junior Instructor in Forestry, University of Michigan, Ann Arbor, Michigan.*

DEVELOPMENT OF CAPTIVE SQUIRRELS

In the Journal of Mammalogy, No. 1, Vol. II, page 77, Roland Case Ross, in writing of captive squirrels speaks of the California Ground Squirrel *Citellus grammurus beecheyi* as "one of the wildest of caged Sciuridae." In the summer of 1926 a very small young one of this subspecies was brought to the O'Rourke Zoölogical Institute by a boy who had grabbed it while it was feeding from his hand. This little squirrel tamed readily and greatly enjoyed playing with or being handled by humans. As a result of this, in January of 1927 a pair of wild adults were trapped and caged with the hope of taming them. They remained very wild, however, and hid in their nest box whenever anyone entered the room in which their cage was placed.

On Feb. 22, 1927, five new-born young were found in the nest and on the same date the male was removed and confined in a separate cage. These young grew and developed very slowly and it was not until April 2, when 39 days old, that

they began to open their eyes. At this time they were covered with hair but were very scrawny and the head seemed to equal in size the rest of the body. The female was at all times supplied with abundant and varied food but she continued very wild and apparently had little milk for the babies.

Just after they had opened their eyes one of the little ones was taken to my home. It was offered some milk in a spoon and as soon as it tasted the fluid it grasped the spoon with its forepaws and started drinking eagerly. In 3 or 4 days it was eating bread and milk from a dish. By the end of the first week it appeared twice the size of its litter mates but no measurements or weights were taken for comparison.

From this time on it grew and developed rapidly. It had the run of the house and was soon on friendly terms with our two-year-old baby and also with a black and white kitten. Later on the squirrel became so mischievous that it was necessary to return it to the cage at the institute where it had been born. This pet ground squirrel is a female and is now just past three years old but still tame and gentle. The squirrel which was first brought in by the boy became so overfat that she was scarcely able to move about, so she was disposed of in the summer of 1929 when over 3 years old. This younger one, however, keeps in good condition by daily exercise on an inclined wheel.

These notes are interesting in comparison with the published observations of others on the development of young *Sciuridae* in captivity. Ruth Dowell Svihla of the University of Michigan notes (Journal of Mammalogy, Vol. II, No. 1, pages 79–80) that an under-nourished brood of red squirrels, *Sciurus hudsonicus loquax*, were 35 days old before opening their eyes while a better cared-for brood of the same species had theirs open on the 27th day. Otis Wade states (Journal of Mammalogy, Vol. 8, No. 4, pages 269–275) that young *Citellus tridecemlineatus* open their eyes in from 26 to 28 days, basing his statement on observations of but a single brood of this species. A study of the illustrations accompanying his article (Figs. 1, 2, 3, Plate 23) shows that his squirrels had abnormally large heads for such young animals and this would seem to indicate a subnormal development.

W. T. Shaw in writing of the habits of the Columbian Ground Squirrel, *Citellus columbianus columbianus* (Monthly Bulletin, Calif. State Com. of Horticulture, Vol. VII, Nos. 11 and 12, page 713), states that young of this species begin to open their eyes when but seventeen days old. In the caption under Fig. 37 on page 715 he states that this consisted of a "twitching over the eyes, which, in the course of two or three days, results in opening the eyelids." This would mean that the eyes were actually opened in 19 or 20 days. The young squirrels illustrated (Figs. 34–38) seem to show a normal proportion between head and body.

Summary. *a.* One *Citellus grammurus beecheyi* taken quite young and one born in captivity became tame and were good pets.

b. A brood of young *Citellus grammurus beecheyi* began to open their eyes when 39 days old. Their development was decidedly subnormal.

c. A brood of *Sciurius hudsonicus loquax* opened their eyes when 35 days old and their development was subnormal. A second brood had theirs open when 27 days old.

d. A brood of young *Citellus tridecemlineatus* opened their eyes in from 26 to 28 days. Judging from the proportionate size of head and body their development was subnormal.

c. A brood of young *Citellus c. columbianus* began to get their eyes open when but seventeen days old. From the proportionate size of head and body shown in the illustrations their development was normal.

Conclusions. a. California Ground Squirrels may be readily tamed if taken when quite young.

b. The development of young *Sciuridae* in captivity is apt to be subnormal and should usually not be considered as paralleling the normal development of young of the same species in the wild.—FRANK F. GANDER, *O'Rourke Zoölogical Institute, Balboa Park, San Diego, Calif.*

THE STATUS OF ORTHOGEOMYS CUNICULUS ELLIOT

In treating the pocket gophers of the genus *Orthogeomys* a reference to *O. cuniculus*, prepared for insertion in the galley proof, was overlooked and the list of forms as it appeared (Journ. Mamm., vol. 11, No. 2, May, 1930, p. 156) was therefore incomplete. The type locality of *O. cuniculus* was originally given (Proc. Biol. Soc. Wash., vol. 18, December 9, 1905, p. 234) as Yautepec, Oaxaca, Mexico. A correction by the author (Publ. Field Columb. Mus., Zool. Ser., vol. 8, 1907, p. 312), however, indicates that the type came from Zanatepec, Oaxaca, about 65 miles east of Tehuantepec, the type locality of *Orthogeomys scalops* Thomas. Geographic considerations would suggest that close relationship of *cuniculus* to *scalops* might be expected. Careful comparison, however, of the type of *cuniculus* and of the single available topotype, a very young individual, with a considerable number of *scalops*, reveals apparent differences so trenchant that *cuniculus* must continue to be regarded as a distinct species. Contrasted with topotypes of *scalops* of the same sex and similar age the adult male type skull of *cuniculus* differs most strikingly in smaller size (*scalops*—condylobasal length, 67.4, zygomatic breadth, 41.6; *cuniculus*—condylobasal length, 58.3, zygomatic breadth, 36.6), and cranial details appear also to be distinctive. To the list of forms published (l.c.) should therefore be added: *Orthogeomys cuniculus* Elliot. Zanatepec, Oaxaca, Mexico.—E. W. NELSON AND E. A. GOLDMAN, *Biological Survey, Washington, D. C.*

IDENTITY OF HESPEROMYS INDIANUS WIED

In 1832–3, at the historic colony of New Harmony, Indiana, Prince Alexander Philipp Maximilian of Wied collected a mouse which he described in 1862 (p. 111). With some misgivings he assigned to it the new name of *Hesperomys indianus*, remarking in the description that the animal was very like the European house mouse. I have not seen the name repeated in the literature except in Coues' Monograph (1877, p. 51) where it was tentatively placed as a synonym of *Peromyscus leucopus*.

The type came into the possession of the American Museum of Natural History with the acquisition of the Maximilian Collection. It now is assigned A. M. N. H. No. 575.

The specimen is a badly discolored mounted skin, without skull, which could compare only with *Reithrodontomys humulis merriami* or *Mus musculus musculus*. The relatively short first toe, the uniformly colored and longer tail, as well as the longer body indicate conclusively that the animal is the introduced house mouse. In his description the Prince of Wied described *H. indianus* as possessing four

cheek teeth in each row, above and below, which I can only believe to be a misprint, for no mouse with which the type compares at all closely has such a dental formula.

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—ROBERT T. HATT, *American Museum of Natural History, New York.*

COMMERCIAL FERTILIZER FROM WOOD RAT NESTS

In the early nineties while collecting specimens for the Biological Survey I secured many species of wood rats, some of which proved to be new and were later named by Doctor Merriam and others. In the chaparral country of California they were especially abundant and their houses were often very large and old.

At Carbondale, where the type of *Neotoma fuscipes streatori* was taken, I first made a careful study of wood rat houses and the excavations under them. After removing the sticks and trash from which the houses were built I found large deposits of excrement in the ample basement rooms where it had been accumulating for many generations of wood rats.

Later, in other localities, and especially in Santa Cruz County, where *Neotoma fuscipes annectens* is abundant in the tall chaparral and among the live oaks, where they build stick houses sometimes six feet high, the basements were found to contain several bushels of excrement. In some cases there would be from one to three sacks and under older and larger houses as many as ten or even twenty sacks of this manure of purely vegetable origin. I called the attention of local florists to this supply of fertilizer and they have found it so effective that hundreds of sacks have been gathered and shipped to greenhouses in neighboring cities. It is considered especially beneficial for ferns and such plants as require an acid soil, although I am not aware that any chemical analysis has been made.

Locally the use of this fertilizer has become quite general but over the chaparral country of western California it could probably be made equally beneficial over a much wider area although not on a large commercial scale.

In certain localities these wood rats may do some mischief in carrying of fruit or nuts or grain but generally they are harmless animals of the waste land, feeding mainly on leaves and green vegetation and living simple, interesting lives. They could remain indefinitely and go on storing fertilizer in their cellars if the houses are not destroyed but the accumulation would of course be slow. So many of our rodents are injurious and have to be controlled that it is a satisfaction to find one that is in a small way useful to agriculture.—CLARK P. STREATOR, *Former Field Naturalist of the Biological Survey, Santa Cruz, California.*

NOVA SCOTIA RED-BACKED MICE—CLETHRIONOMYS GAPPERI OCHRACEUS

The summer of 1928 was our tenth in succession spent at Lake Kedgemakooge in central Nova Scotia. For four or five years we had become intensely interested in trapping small animals, not only for museum specimens, but for keeping alive

and studying certain characteristics. During the summer of 1926 we first began to trap red-backed mice. They were not rare, but not noticeably numerous either. In 1927 there seemed to be a marked increase. We hardly ever failed to catch them in our traps and often would find more than one in a bottle trap.

At our camp about ten miles from Kedgemakooge, situated on Beaver Lake, where we lived in open tents, often spending a week or ten days at intervals during the summer, we were entirely away from human civilization and did our best to encourage wild pets to come around us without fear. Very soon we noticed many red-backed mice around the camp everywhere, coming out quite boldly in the full daylight and hunting for bits of bread or rolled oats which we scattered out. This gave us a wonderful chance to watch their doings outside of captivity. They were extremely active and largely diurnal in their habits. Near our tent was a short hole with two entrances above ground about two feet apart. This was used by both chipmunks and red-backs. It was amusing to watch one of the latter try to pull down after him a piece of bread too big for the entrance of the burrow. He would tug at it fiercely and then turn it around and try to fit it in another way. After about fifteen minutes he completely gave it up and left it blocking the entrance until a chipmunk carried it off. These mice used our woodpiles as refuges and would run with bits of food from the open to the woodpile and stay there to finish their meal.

One morning, awakened by a slight scratching noise near my head, I kept quiet and soon saw a pair of bright eyes looking at me over quivering whiskers hardly a foot away from my face! Then the red-back, deciding that I was not dangerous, suddenly scampered across me and away!

We had two tents at Beaver Lake,—one about six feet from the water and the other well back in the woods. At the former we took practically all our meals and that was where we put out the food for our small pets, but they seemed just as plentiful around the other camp. In the early afternoon I once watched four of five young there frisking about playing with each other, apparently oblivious of my presence. They lived in a hole under a tiny stump which was covered with green moss. Just for fun we set a bottle trap by this hole and actually watched the mice go into it for rolled oats. Two or three would enter at the same time and often run in and out without touching the trigger. However when they finally got caught we let them go because usually we never trapped near the tents, preferring to watch the wild creatures free and in their natural environment.

It was sometimes hard to tell where to set traps for them because they didn't leave many signs. We almost always had good luck near the shore of the lake under tall thick huckleberry bushes which grew abundantly everywhere. The mice ate the berries, probably climbing up into the bushes for them. We also had good luck near sphagnum moss and I once noticed a red-back eating it while in captivity.

As pets they did not become very tame. One morning, however, we found a red-back in one of our bottles nearly dead with cold as the temperature had been unusually low during the night. He was quite unconscious when we found him and I warmed him back to life in my hands. Ever after that he was unusually tame and gentle, often allowing me to handle him and stroke him softly.

Once we had a family of five born in captivity and soon after they had become old enough to run about and fare for themselves their mother died. Later we found only her skull and skin remaining, so the five young must have eaten her.

In the summer of 1928 we returned to Nova Scotia, looking forward to watching these attractive little pets, but were greatly disappointed. We never saw one around the camp that year and it was almost useless to set traps for them even at Kedgemakooge because they never came. Everywhere there seemed to have been a sharp decrease in their numbers.

What had happened to them all we could only surmise. Perhaps, because they were growing so plentiful a disease had wiped them out, as has been noticed and recorded in the case of other microtines.—CAROLYN SHELDON, *Milton, Mass.*

A PILE OF MICROTUS

While botanizing in the rich subdunal woods of the southeast corner of the Dunes State Park, Porter County, Indiana, April 13, 1930, I came across seven dead *Microtus pennsylvanicus* lying more or less on top of one another and all in disorder. Associated with them and partly obscured by them was one dead *Peromyscus maniculatus bairdi*. It was a warm sunny afternoon, so that all the specimens were soft and flies were buzzing about them and beginning to blow them. The mice could scarcely have been piled up any earlier than the preceding night. No blood stains were on them and they showed no evident marks of violence except that their backs and shoulders felt broken. All were adult. A male and female of the least soft of the *Microtus* and the *Peromyscus* were taken home to skin. In skinning the *Microtus*, injury of the backs and shoulders was confirmed and areas of hemorrhage were found beneath the skin. The skin over the shoulders had a few irregular holes 2 or 3 mm. in diameter. The *Peromyscus* was too soft to skin and only the head was saved. The hair of the backs and shoulders of all of them gave the appearance of having been wet with saliva, which had dried. An old clearing covered with grass and suitable for *Microtus pennsylvanicus* and *Peromyscus maniculatus bairdi* was not more than 100 feet away. The impression was gained that the mice had been collected by a small carnivore such as a weasel. The pile was located in a perfectly level space in the woods, free from debris and in no way associated with anything resembling a den or other shelter—MARCUS WARD LYON, JR., *South Bend, Indiana.*

ANOTHER RECORD OF THE BUFFALO IN OREGON

During June, 1929, Judge Robert Sawyer, of Bend, Oregon, accompanied me on an expedition into south-central Oregon, primarily for the purpose of seeing the herds of antelope ranging in that district. On June 14, while I was otherwise engaged, Judge Sawyer investigated the site of Old Fort Warner, which was established as a military station on July 15, 1866, and abandoned September 1, 1867, thus being occupied about fourteen months by soldiers operating against hostile Indians in that region.

The location is about twenty miles east of Warner Valley, Lake County, Oregon, and at an altitude of approximately 6,500 feet.

During Judge Sawyer's investigations, he found, among other material, a four-inch fragment of the upper end of a rib bone, which upon being submitted to the Biological Survey, was identified as "a four-inch section of the upper end of the sixth rib from the back or eighth rib from the front on the left-hand side of a medium-sized bull buffalo" (*Bison bison bison*). The specimen is now deposited in the National Museum collection to substantiate the record.

The following statement from Judge Sawyer describes the finding of this interesting record:

"The bone about which you ask me was found in one of the fire places which I excavated. As I remember it was about two feet below the surface. Apparently, when this camp was abandoned, its occupants threw into the fire places all sorts of waste material. I found an ink bottle, a perfumery bottle, broken wine bottles and many pairs of heavy boots with the leather badly rotted. It was in one of these collections of material that I came upon the bone fragment."—STANLEY G. JEWETT, *Portland, Oregon.*

FOOD OF THE GRAY AND OTHER WHALES

To Americans one of the most interesting whales is the species usually called California gray (*Rhachianectes glaucus*), whose status along our shores is now extremely critical for the reason that it is doubtful whether more than a few dozen individuals survive in the eastern Pacific. Curiously enough its food has remained unknown, it having escaped the investigation of that keen, pioneer cetologist, Captain Scammon. Referring to this species the latter (1874) has stated that "They are known to descend to soft bottoms in search of food, or for other purposes; and when returning to the surface, they have been seen with the head and lips besmeared with the dark ooze from the depths below." But "To our personal knowledge, but little or no food has been found in the animal's stomach. We have examined several taken in the lagoons, and in them we found what the whalers called "sedge" or "sea-moss" (a sort of sea-cabbage), which at certain seasons darkens the waters in extensive patches both in and about the mouths of the estuaries. Whether this was taken into the stomach as food some naturalists doubt, giving as a reason that the whale, passing through the water mixed with this vegetable matter, on opening its mouth would of necessity receive more or less of it, which would be swallowed, there being no other way in which it could be disposed of. The quantity found in any one individual would not exceed a barrel-full."

"From the testimony of several whaling-men whom we regard as interested and careful observers, together with our own investigations, we are convinced that mussels have been found in the maws of the California Grays; but as yet, from our own observations, we have not been able to establish the fact of what their principal sustenance consists."

The present authors know of no additional published light that has been shed on the food habits of this species. The California gray is a littoral whale and at least in the southern parts of its range, before it was so sorely harassed, seldom ranged outside of the shallow waters in which the great kelp beds are found, and often occurred within the line of breakers, or about rocky headlands. This habitat would suggest that it is partial to other fare than that which is favored by the whales of deeper waters, such as the humpback and finback. On the other hand, it does not seem likely that this animal would feed extensively upon mussels. The shells of these molluscs are sharp, and to secure them in the quantity required would necessitate great digging activity, backed by the momentum of great body weight, so that it would be hardly possible for the beast to escape violent contact with all manner of sharp rocks upon the bottom, and its rubbery muzzle, easily scored even by a fingernail, would suffer serious laceration.

As contributing to the solution of this puzzling question it is therefore of interest that the gray whale landed at the whaling station at Trinidad, California, July 21, 1926, had within its mouth and among its baleen a quantity of the small shrimps (identified by W. L. Schmitt as *Euphausia pacifica* Hansen), apparently similar to those upon which the finbacks were then feeding extensively. This individual, a male of 39 feet, had been killed close to shore and "almost on the rocks" near Crescent City. It was in company with four others and was the only individual of the species ever secured at this station. Because of the length of time necessary to tow it to Trinidad decomposition had set in, the subcutaneous tissue having turned green. Partly for this reason we did not pry into its stomach contents, as would have been desirable, but there is no doubt that it had been feeding upon the shrimps. Whether this is the normal food of the species, or whether it will turn to any small food available as will the larger whales, and the shrimps were but incidental, we are, of course, unable to say.

Unfortunately the whales at this station were cut up and disposed of so speedily that we were unable to make complete observation of any one individual, and often while the stomach was being slit and its contents quickly shovelled into a vat we were occupied in investigating some other anatomical detail. So we are unable to state exactly how many whales, of those we observed, contained shrimps and how many held fish. The California Sea Products Company kept a record of species, length, and stomach contents, however, and of the humpbacks and finbacks caught previous to our arrival, 10 of the former contained shrimp and 6, "sardines," and of the latter, 16 had fed on shrimp and 5 on "sardines," and only one stomach, of a humpback, was empty. We suspect that in these brief reports the term "sardine" was used to include any small fish. In them no other species of fish is mentioned, while among the number which we personally observed to contain fish there were no sardines, but only a small mackerel-like fish some 10 inches in length. Some of the stomachs held a quantity of these which we estimated would fill about three standard barrels, and in one individual, killed instantly while feeding, there was a procession of these fish, in single file, all headed down the narrow oesophagus.—A. Brazier Howell and Laurence M. Huey.

COLOR VARIETIES OF LONG ISLAND MAMMALS

Among a small series of mammals recently sent to me for identification are several abnormally colored individuals. The collection was made on the eastern end of Long Island, N. Y., and the close lying Shelter Island, by Mr. Roy Latham, of Orient, L. I. The specimens are in his private collection and the numbers given here are his. To Mr. Latham I extend my thanks for permission to publish these records. The several examples are:

Microtus p. pennsylvanicus, No. 26, ad. ♂. Shelter Island, N. Y. October 22, 1928. Skin and skull, a complete albino, every hair pure white. Neither rhinarium, soles of feet, nor any part of skin shows a trace of pigment, except skin of tail, which looks blackish, perhaps due to dried blood or to the tail wire. Tail unusually short, measuring only 25 mm. In a letter, Mr. Latham says: "This was taken in a wood lot on Shelter Island and the man who captured it alive told me there were several there. But whether he saw more than one at a time I cannot say."

Microtus (Pitymys) pinetorum scalopsoides. No. 15, ad. ♀. Mattituck, L. I., N. Y., June 19, 1927. Skin and Skull. Pelage midway between tilleul buff and vinaceous buff of Ridgway. Underparts only slightly lighter than dorsal surface. Dorsally the bases of hairs approach light mouse gray. Apical third of hairs a buff shade, which gives the mouse its uniform color. Skin of hands and feet and general body surface unpigmented. Mr. Latham informs me that the eyes were black. Two other similar specimens were plowed out at the same time. A farmer in Cutchogue, Long Island, also plowed out one of these light colored pine mice. The animal was captured and kept alive for several months. The specimen undoubtedly represents a case of the restricted yellow ("black-eyed yellow," "fawn" or "cream") mutation already widely known in rodents and other mammals. This mutation, though previously reported for the meadow mouse, appears to be unrecorded from the pine mouse. The gene acts to restrict melanic pigment to the eye in contrast to the allelomorphic dominant which governs extension to the fur.

Ondatra z. zibethica. No. 41, ad. ♂. Orient, L. I., N. Y., December 28, 1929. The guard and fur hairs everywhere appear black except as follows: Upper lips, cheeks, throat, inner side of fore legs and inguinal region normally colored. Over belly and a small area on each rump tips of guard hairs are apricot buff. Hair fringes of toes silvery gray. On close examination the black of back is seen to be relative; in certain lights the hairs show a faint brownish sheen. Under fur in all but its tip a pale neutral gray. Terminally there is a faint trace of brown. Mr. Latham says of this color phase: "Black muskrats, while rare in this section of Long Island are caught at the rate of two or three a winter, but I have only been able to secure two personally from trappers."

Sciurus carolinensis leucotis. No. 4, ad. ♀. Easthampton, L. I., N. Y., April 12, 1922. Skin and skull. A melanistic gray squirrel. Dorsally pelage is black, speckled with cinnamon buff. Tips of all caudal hairs of this latter shade, and because of their distichous arrangement the tail shows a lighter colored fringe. Ventrally the pattern is mottled, for the hairs are variously grouped into sections that are black-tipped or cinnamon-buff-tipped. The factor or factors governing such melanistic forms of the gray squirrel will probably be found to act by controlling the extension of the black and brownish bands of the hairs. Specimens of this squirrel showing the action of this mutation are, of course, very common, while albinos and black-eyed yellows also occur.

Mustela n. noveboracensis. No. 13, ad. ♂. Orient, L. I., N. Y., May 1, 1924. One of the sulphur-bellied individuals encountered occasionally in this group. Coloration probably genetic though Schumacher (Schumacher, Siegmund, 1928, Wie kommt die Stellenweise Gelbfärbung des winterweissen Wiesels zustande? Zeitschr. Wiss. Biol.; Abt. A.; Morph. Okol. Tiere. 11, (229–234) attributes it to anal-gland staining.

Blarina brevicauda talpoides. No. 23, subadult ♀. Orient, L. I., N. Y., June 15, 1928. Skin and skull. The specimen is many degrees lighter in color than any other in the American Museum collection. Dorsally, it is close to the mouse gray of Ridgway. Light shade due to combination of the hair tips being lighter than ordinary and the basal four-fifths of the hairs being a very light silver gray, in contrast to the dark iron gray of the average specimen. Mr. Latham tells me that he has another similar specimen in alcohol.—ROBERT T. HATT, *American Museum of Natural History, New York, N. Y.*

PREPARING MAMMAL SKINS IN THE FIELD

In the course of many years field work preparing bird and mammal skins, the necessity of a quick temporary method of preparing specimens in the field, when time was limited, has often presented itself.

To meet such a situation and to speed up operations where mammals were plentiful, I have recently been experimenting to find a method whereby specimens could be preserved in the field in quantities, to be worked up later in the laboratory.

For the best results, any method must insure thorough preservation and at the same time keep the skin in a soft, pliable condition. In the beginning of these tryouts, small mammals were skinned out, salted, and allowed to dry. This proved only partly satisfactory; the tails had to be wired in the field, and upon working the skins over later, the feet had hardened and considerable trouble was encountered in relaxing the dried skin.

When the entire animal, with viscera removed, was simply placed in a salt solution, the hair invariably slipped when an attempt was made to skin the animal later.

A formalin solution or an alcohol bath were not satisfactory. The formalin hardened the animal until it resembled a dill pickle, and alcohol is sometimes hard to get.

The final result, which has proved very satisfactory, is a salt and alum pickle, as follows:

Water	1 gallon
Salt	1¼ lbs. (or 1 quart)
Alum	¼ lb. (or 1 pint)

In use, I generally take on collecting trips a couple of quart or half-gallon preserve jars half full of the solution. The animals, after being skinned and temporarily tagged, are placed in the pickle where they will keep indefinitely. In preparing the specimens in the field, there is one precaution that must be taken, however; to be certain that the solution reaches every part of the inside surface of the skin. It is therefore necessary to open the skinned out tail with a small wire or thin pointed bamboo stick, pushing the point through the end of the tail, so the solution reaches every part of the inside and drains out the tip. After the stick has been moved back and forth a few times while immersed, there will be no further danger of the tails closing and sticking together.

As this method was designed for speed, it is unnecessary to do any fleshing in the field, and the skins can be cared for at the rate of 25 or more an hour, to be worked over later at one's leisure. The skulls should be numbered and must be kept separate, as the alum has a harmful effect on them.

In working up this material later, my general plan is to soak the skins in fresh water for a couple of hours, through several changes, then put through a gasoline bath to remove the grease and surplus water, and dry in plaster, corn meal, or sawdust.

I have used a gallon of pickle to put up 100 small mammals, and have also used the same solution a second time by adding a little more salt and alum to keep it up to strength.

If the specimens are worked up within a day or two after being pickled, the ears and unskinned parts of the feet will still be rather soft, and may slip if not carefully handled, but the hair will be thoroughly set in a week and you can "treat 'em rough" with a clear conscience.—GEO. G. CANTWELL, *Los Angeles Museum, Exposition Park, Los Angeles, Calif.*

SYMPOSIUM ON PREDATORY ANIMAL CONTROL

TWELFTH ANNUAL STATED MEETING OF THE AMERICAN SOCIETY OF MAMMALOGISTS, HELD AT THE AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY, MAY 21–24, 1930

WEDNESDAY MORNING SESSION

May 21, 1930

PRESIDENT WITMER STONE, presiding. Presentation of paper entitled:

THE COYOTE—ARCHPREDATOR

BY E. A. GOLDMAN

Senior Biologist, Bureau of Biological Survey, U. S. Department of Agriculture

How to deal with the larger predatory mammals—whether their depredations should be tolerated, whether they should be subjected to limited control over their entire range, or whether extermination in certain areas, or everywhere, should become a fixed policy—is a problem concerning which there is difference of opinion. Opinion, in fact, ranges from the belief that the balance of nature would be restored if we only refrain from killing anything, to the conviction that all carnivores should be exterminated as 'vermin.' Between these extremes are many shades of opinion representing conflicting interests and the varying views of those who may be regarded as more rational. One of the elements of the problem concerns the changed conditions brought about by the advent of civilized man.

At the time of the discovery of North America, the general range of countless numbers of large game animals, such as buffalo and elk, was measured by nearly the full width of the continent, and innumerable antelope roamed the western grassland plains from Alberta and Saskat-

chewan to northern Mexico. Deer were plentiful, while moose and caribou, mountain sheep, and bears in large numbers occupied vast areas. The larger carnivores, mountain lions, lynxes, bobcats, wolves, and on the western plains, coyotes, followed and preyed upon the game herds, and the surplus afforded food for great numbers. Primitive human tribes, armed with bows and arrows, existed largely as so many predatory animals, with negligible effect on the general numbers of the game.

But the occupation of the continent by Europeans bearing firearms, clearing the forests, and settling permanently throughout its extent brought changes usually in direct ratio to the density of the new human population. From the early settlements, largely near the Atlantic coast, intensive occupation of the country has spread gradually westward until it now embraces nearly all of the more favorable sections as far as the Pacific littoral. The profound changes brought about by man in his progressive encroachment on the haunts of the larger game, especially along with his too indiscriminate use of modern firearms, have led to the disappearance of most species over much of their former range. Those that remain have been forced to seek the more inaccessible regions, especially the mountains in the west, fortunately now largely within the national forests and national parks.

The large predatory mammals—mountain lions and wolves—require for proper sustenance animal food in large quantities. Owing to this compelling need, coupled with abundant power to kill, their preference is for large game, and in their normal diet small animals such as rodents and birds form an inconsiderable part. In order, therefore, to procure accustomed food they followed the retreating game, or where this was gone and they were permitted to exist, their attention was turned to the livestock of the settlers, and some sections were rendered unremunerative as grazing areas. As a result of Federal and State coöperation satisfactory progress has been made in the control of the larger predatory animals with the exception of the coyote, which has proved to be the archpredator of them all.

In the days of the buffalo and other abundant western game the coyotes were probably largely scavengers, being overshadowed as killers by the numerous wolves and mountain lions. With the disappearance of the large game, however, the wolves and lions, more dependent upon such animals for food, became scarcer, leaving the coyotes as the dominant predators. Coyotes are peculiarly favored by their size, which is small enough to enable them to escape easy detection, and to subsist upon game birds, rodents, and other small animals; and yet they are

large and powerful enough to constitute a very serious menace as large game and stock killers. Many young deer, antelope, sheep, pigs, poultry and calves become their victims. Coyotes have shown a very remarkable, somewhat fox-like, adaptability to the changed conditions resulting from human occupation, and are greatly extending their range in certain directions. Formerly they occupied the western plains and basal mountain slopes from western Canada and the United States south over the tableland of Mexico, and the tropical savannas along the Pacific coast as far as Costa Rica. Wolves became extinct in southern Mexico, owing to reprisals for their inroads on domestic stock many years ago, but coyotes have held their own, although apparently never very numerous, or a very serious menace to human interests in the tropical parts of their great range. The comparatively small numbers of coyotes on the tropical savannas may be due to the lesser abundance of rodents and birds of suitable size for food, and to the competition of the tiger cats and other tropical predators.

In recent years coyotes have pushed northward, however, from British Columbia and Yukon Territory into the Yukon Valley and are reported to have reached Point Barrow, Alaska, and the mouth of the Mackenzie River in Canada. Investigations carried on in coöperation with the Territory of Alaska have revealed their destructive activities at many points. Coyotes were first reported in Alaska at various places from the Yukon River to the Russell Glacier near the International boundary from 1915 to 1917. For the first few years, as might be expected, the rate of increase and spread was not nearly so rapid as in the past three or four years. The direction of the invasion at first was largely westward down the Tanana drainage system and southwestward through the Copper River and Chitina valleys. More recently it has passed on to the Kenai Peninsula and the Talkeetna River toward the Broad Pass country. Reports show that during the winter of 1927–28 the advance reached the upper Kuskokwim River. Coyotes have spread along the Yukon to below the mouth of the Tanana River, and in other directions. They have been known near Anchorage for about four years.

According to a resident of Telegraph Creek near the Stikine River, Canada, no coyotes were known in that section prior to 1899. About that time, however, they came in, apparently following the old gold-rush trail, probably attracted by the hundreds of dead horses along it. The invasion of Alaska seems destined to continue until coyotes have extended their range over practically all of the Territory.

It has been found in Alaska that the coyotes kill many foxes, and at pupping time the foxes are chased from their dens and the dens used for rearing their own young. Since the coyotes have increased the foxes have decreased alarmingly. In some sections practically none are believed to be left. Since the coyotes have come in the native trappers are having a hard time, even at high fur prices, to make their work profitable. Since the furs they take are almost their sole source of revenue their situation is serious. An extract from the report of the investigations which covered the period from July 1, 1927 to February 28, 1929 is quoted as follows: "It is even possible to trace the advance of coyotes by a marked decrease in the fox population, and the trappers note it with dismay, for they are thus deprived of a valuable source of revenue. . . . In many cases a family or entire colony of foxes are run out of their dens or are both run out and killed by coyotes which then use the den themselves. Wolves are well known to have committed similar depredations, but their killing is not so extensive as is that of the coyotes. Serious as are the depredations of wolves throughout most of Alaska, the damage done to game and fur bearing animals by coyotes is not only far greater but is rapidly increasing in extent.

"The depredations of coyotes are a contributing factor in the slower increase of ptarmigan and snowshoe rabbits, when the natural life cycle has depleted the number of these birds and rodents. . . . In those sections of Alaska where coyotes find rodents for sustenance their killing of them contributes to the lessening of this food supply for the more desirable fur bearers. How far the coyotes will hold back the normal development in the periodical increase of the snowshoe rabbits and the ptarmigan, which are important items in the food supply of fur bearers, especially the lynx and the fox, it is impossible even to approximate. Whatever that ratio is, however, it is certain that the coyotes are detrimental to the same degree to the well being of these fur bearers, the life cycle of which quite uniformly follows that of the snowshoe rabbits and ptarmigan.

"During the investigations in the upper Tanana in the late summer of 1927, it was found that coyotes were preying rather heavily upon the ducks and geese. Reports of residents indicate that during the past few years nesting waterfowl have decreased greatly since the coyotes have become more plentiful. The Tetling Lake and the Gardner Creek sections are important nesting areas for waterfowl, and here it was found that the coyotes have concentrated in their denning season. It was common to find the feathers of waterfowl in the droppings of

coyotes, and at their dens." It is evident that in Alaska coyotes are advancing directly into the great breeding grounds of the white-fronted, Hutchins, cackling and emperor geese, of the pintail, mallard, widgeon, green-winged teal, spoonbill, greater and lesser scaup ducks, and of many shorebirds. Evidence also indicates that coyotes are preying extensively upon mountain sheep in some parts of Alaska. The coyote situation in Alaska has been dealt with at some length, as it emphasizes the remarkable adaptability of the animal, but much more might be said.

The movement into new territory evidently began in early days. Vernon Bailey states that coyotes were absent from parts of southeastern Minnesota prior to 1875 when they first appeared in Sherburne County, presumably from the great prairies west of the Mississippi River. When they became common the red foxes, formerly numerous, practically disappeared. Some red foxes have, however, persisted in parts of the coyote-occupied territory. Coyotes entered the upper peninsula of Michigan about 1906, and have even gone into forested sections near the coast in Oregon. Many observers have noted that within recent years coyotes have penetrated farther into the higher and rougher sections of western mountains, where they have been found denning at 10,000 feet altitude and are able to prey upon the retreating game and livestock. They are also being reported from localities to the east of their former habitat on the western plains, and the carrying of young coyotes as pets in automobiles seems likely to be a contributing factor in their eastward dispersal. Small colonies are reported in western, central and southeastern Alabama.

In recent years coyotes have been a very serious menace to the human population, as well as to livestock through the alarming spread of rabies, transmitted through them, over several western states. The malady began in central California in 1909, and by 1915 had extended over northern California and much of Oregon, Washington, Idaho, and Nevada. The recorded number of people bitten by November 30, 1923, is over 2,000, of which number 56 died. The prompt application of the Pasteur treatment doubtless saved hundreds of lives. In 1915 and 1916 the losses of livestock from rabid coyotes in Nevada alone were estimated at $500,000. Four hundred head of cattle were reported to have been killed on one ranch. In January, 1922, a new outbreak in Washington was stopped by the concentrated coöperative efforts of Federal, State, and County officials, when 1,800 coyotes had been killed in four counties. In 1923 the disease was suppressed in parts of Cali-

fornia, Oregon, Nevada, Utah, Idaho, and Washington, and in the same year it appeared in coyotes and bobcats in Colorado, where, within a short time, four persons were bitten, and livestock valued at $4,000 was destroyed. This has since been followed by outbreaks in eastern Washington, eastern Oregon, central Colorado, northern Utah, and sporadic cases at widely separated points in Nevada. Experience has indicated that new outbreaks of rabies may be expected from time to time, wherever coyotes become very numerous.

The opinion is expressed by some that coyotes and other predatory animals are necessary in sufficient numbers to control the injurious rodents preyed upon thus preventing their abnormal increase and maintaining the natural balance. This is an attractive and popular idea, but the maintenance of the highly hypothetical natural balance is by no means so simple. It has even been asserted that coyotes are more beneficial than harmful in most localities. Such assumptions evidently ignore the complex conditions involved, and the rôle of the coyote as a destroyer of useful creatures. It is true, of course, that coyotes and the smaller carnivores, including the valuable fur bearers we wish in general to protect, feed extensively upon rodents and thus tend to reduce their rate of increase; but a point difficult for many to understand is that such checks can not be depended upon, and there is ample evidence that two other more important factors determine the number of many rodents. These are, and always have been, the available food supply and epizootic diseases.

The true relation of predatory animals to rodents can most accurately be determined by noting comparative numbers in areas essentially unmodified by human occupation. If the food supply is ample many rodents multiply amazingly in such places in spite of the inroads of predatory animals. This was well shown in an instance that came under my observation in the San Joaquin Valley in California 40 years ago, when the country was still for the most part unsettled. No serious efforts had been made to reduce the number of predatory animals and they were present in apparently normal numbers. Jack rabbits, however, were so excessively abundant and became so troublesome to the scattered farmers that concerted action was necessary to afford relief. Numerous rabbit "drives" were organized in which men, women, and children, arranged in semicircular formation, took part, to the number of several hundred. From a considerable section of open country the jack rabbits were gathered and driven into a wire inclosure, where they were killed. These drives, carried out within a few hours, usually

yielded from 2,000 to 3,000 rabbits by actual count, and in one instance 20,000 were reported. A few coyotes often started along with the jack rabbits, but were usually permitted to escape. The excessive abundance of rodents observed in many places under varying environmental conditions has convinced me that predatory animals alone can not be relied upon to exert the necessary measure of control; and the cycles of increase and decrease in many rodents, regardless of predatory animals, are of course well known.

Another idea that appeals to some, and may even be accepted as demonstrated truth, is that predatory animals are an essential part of nature's plan to eliminate the unfit and maintain wild life at a high physical level. My observations in the field have led me to the conclusion than this alleged beneficial effect of predatory animals may be greatly exaggerated, although having to cope with predatory animals may have had some bearing on the evolution of a race. In modern human society medical science and care lavished on the unfit may cause deterioration of the race, but the conditions that must be met by wild life tend to eliminate the unfit in any case. Many insular species, beyond the reach of predatory animals, appear to be as physically fit as their mainland relatives. Even the assumption that predatory animals more often attack the unfit should be examined with care for we find in the field much evidence that the strong and healthy as well as the weaker animals are killed. Some have advanced the theory that sick animals and birds are singled out and killed by the predators, but such individuals are apt to be motionless and therefore overlooked as it is motion that quickly reveals location.

Civilized man has hopelessly overthrown the semblance of a balance that once existed, by transforming the landscape or creating other artificial conditions nearly everywhere; and the balance can never be reëstablished. Much of our most valued wild life is endangered by predatory animals if left unchecked. The margin between success and failure in the livestock and poultry industries is often very narrow and the inroads of predatory animals may be the deciding factor. Under the new conditions practical considerations demand the most effective management of wild life everywhere. This means that the rodents, as well as the carnivores must be checked wherever they become too numerous, or too injurious to human interests.

As naturalists we dislike to contemplate the eradication of any species, even locally, but as practical conservationists we are forced by the accumulated evidence of many years to decide against such notoriously

destructive predators as mountain lions, wolves, and coyotes. Some of those opposed to extensive predatory animal repression fear the extermination of these species. None of them may be granted asylum in areas occupied by the homes of man and his domestic animals, but the general range of the mountain lion still extends through over 100° of latitude. Wolves will continue indefinitely in sparsely inhabited regions, and it is doubtful whether the coyote was ever more numerous, in the aggregate, than at the present time. In large sections of the west no organized predatory animal control work has ever been undertaken. The coyote is remarkably successful in rearing its usual six or seven young as attested by its large numbers. The general habits, traits, and destructive propensities of the animal are common knowledge and owing to excessive numbers this bold and ruthless marauder has become the scourge of the western country. By far the major part of the predatory animal work of the Federal, State and county governments, as well as livestock and game associations in the west is now directed toward its suppression. The effective control of the coyote in utilized areas is the urgent first need, the extermination of so adaptable an animal being an impossibility.

The number of coyotes on national forests, estimated by the Forest Service in 1928, the last year for which the figures have been compiled, is 200,000, and it should be remembered that the greater density of coyote population is outside the limits of national forests. While opinions vary it seems probable that most reasonably well informed persons recognize the necessity for some repression of the coyote. If this is granted it remains then to be determined what measure of control should be applied, and what methods should be adopted to bring this about. Since many millions of dollars in livestock, and wild life resources of immeasurable value are affected the need for an extensive program of control is imperative. No half-way measures will serve the purpose.

Methods of controlling the various kinds of injurious animals without destroying useful species have received the attention of the Biological Survey for many years, and a section of the staff is regularly engaged in studies which have resulted in many improvements. It is believed by some that coyotes could sufficiently be checked by chasing with hounds, shooting, and trapping when the fur is prime. If this could be done it would, of course, obviate the necessity of using poison, which, especially when not closely supervised, is admittedly seriously objectionable; and the poisoning of some fur bearing animals we wish to protect is unavoidable. Hounds are used to some extent in open country,

shooting is done as opportunities are afforded and trapping is a method very extensively employed. It has been found, however, that hounds have a very limited use. Obviously they can not be used in National Forests, where 100,000 head of sheep were killed by predatory animals last year according to figures compiled by forest officers, nor in rough country and important game fields elsewhere, and shooting these skulking, mainly nocturnal animals is an exceedingly uncertain way of disposing of them. Aside from poisoning, trapping is the most effective and satisfactory known method of taking coyotes, but even this alone has proved to be slow, and therefore costly and inefficient, compared with the expert use of poison.

While poison is objectionable it is by far the cheapest and most efficient known agent for dealing with coyotes and various kinds of injurious animals, including the rodents, where they are abundant and conditions are suitable. It should be understood that poisoning is practiced under Federal direction only at certain seasons, and not indiscriminately throughout the year. Moreover, it is not so generally employed as may be supposed. Of the states covered by general control work no poison is used by the Biological Survey against predatory animals at present in Oklahoma, Arkansas, Minnesota, Wisconsin or Michigan, and it has a very limited application in some other coyote infested states. To discontinue its use under expert direction, however, in the absence of a similarly effective substitute would render the control of the coyotes in much of the heavily infested territory exceedingly difficult, if not an impossibility. The result of such a course would probably be that in order to protect their interests many stockmen, farmers and others including some of those wishing to safeguard game would employ poison with little regard for its effect on wild life in general.

One of the objections raised against the use of poison is the inevitable killing of some fur bearers, especially skunks, badgers, and foxes, for which it is not intended. Special efforts are made by the field leaders of the Biological Survey to avoid having poison placed where the smaller fur bearers will be likely to find it. Some poisoned fur bearers are regularly reported, but the number compared with that of the coyotes disposed of is small, and there seems to be no definite evidence of any marked decrease in small fur bearers due to poison used under the direction of the Biological Survey. There is, however, evidence that decreases in places are due to overtrapping, owing to high prices paid for furs. Some of the objectors to the use of poison, owing to the incidental killing of some fur bearers, urge trapping as a suitable alternative. But

they apparently overlook the fact that the small fur bearers are usually far easier to trap than the coyotes and some are sure to be taken under any such plan.

Biologists and conservationists in general are, of course, interested in all phases of wild life administration, and constructive criticism is always worthy of serious attention. Some mistakes in the handling of large projects are inevitable and should be subjects for frank discussion with a view to better understanding and correction [but no constructive criticism can be based on false premises, on half-truths, or consist largely of statements supported only by hearsay evidence, which serve to arouse prejudice in the minds of those who are interested.]

Much has been learned of the coyote but its true rôle as a destroyer, and especially its amazing expansion while so many other species have declined, should be better and more generally known. The results of investigations in Alaska, extending over a year and a half and to which reference has already been made, were set forth all too briefly, owing to lack of space, by the Chief of the Biological Survey in his annual report for 1929. Corroborative evidence against the coyote from many sources has been accumulating until to many most familiar with the animal it seems overwhelming, and it is inconceivable that any investigations could alter the decision as to the necessity for its extensive repression. How can we treat as of little importance the inroads of an animal that in many places threatens the success of the livestock industry, in which many millions of dollars are invested, and which furnishes a livelihood for a large section of our people? How can we ignore its destruction of useful wild life, and its menace to public health as a carrier of rabies? If the present program of control is to be abandoned or greatly modified, what clear-cut, practical alternative will serve the purpose? It seems a reasonable forecast that additional studies will confirm the conclusion that the coyote is the archpredator of our time.

PRESIDENT STONE: Discussion is in order.[1]

MR. H. H. BAILEY: Mr. Goldman made a remark about people carrying coyotes on automobiles as pets. In Florida we have that condition to contend with, and they will probably become a menace in time to come because, as the Spanish Trail has been opened from Florida to California, our "tin can" tourists go back and forth and bring in coyotes. Already I have had several reports of small dogs, or as they call them, "German police dogs," running around, which proved to be

[1] This discussion and those that follow are printed as they stand in the stenographic record of the meeting.

coyotes, destroying fowls and some of the smaller stock. I do not know how many reports the Biological Survey has had on the subject, but each summer and each winter as the "tin can" tourists go back and forth, unless we put a stop to it, we are going to have a lot of coyotes brought into Florida. Mr. Goldman, have you had any reports along that line?

MR. GOLDMAN: There have been a number of instances where coyotes have been carried into Eastern states, brought in as pets by people coming East in automobiles. These coyotes may be kept tied or something of that sort at first but they get loose and of course if they happen to mate with another coyote they start a local colony of coyotes and it remains to be seen how far these animals may go. There is a possibility we may have trouble in controlling the coyote in this way. I might mention that coyotes have recently been imported in northern Georgia, and they are appearing from time to time in various places in the East.

DR. JACKSON: Mr. Goldman mentioned the coyote being absent from Minnesota before 1875. Of course, I do not doubt that statement, but some time ago I searched in the old manuscripts in the Wisconsin State Historical Library. There were records of coyotes appearing in Wisconsin as early as the beginning of the nineteenth century, along around 1804. I found records of coyotes in Rock County, Wisconsin, which is in the central-southern part of the state, as early as 1839, and in Prairie du Chien in 1822, definite records, but Prairie du Chien was settled in the eighteenth century, probably around 1760 to 1770, and was named Prairie du Chien on account of the coyotes in that region.

MR. A. B. HOWELL: From Mr. Goldman's talk I gather that he charges coyotes with the extensive destruction of foxes, not only in Alaska but in other places. If the coyote is such a danger to the fur bearers why are there any fur bearers today? The coyote has been living for several million years. It seems to me in that time it had opportunity to clean out all the foxes in the United States.

MR. VERNON BAILEY: Mr. Chairman, we do not want to get our species mixed too much. Mr. Howell refers to the gray fox of another genus, *Urocyon*. Major Goldman and I in Minnesota refer to the red fox, *Vulpes*. These animals are entirely different, the *Urocyon* always ready to climb a tree or take refuge in the rocks, while the *Vulpes*, the red fox, burrows in the mellow ground and lives in the open and has very low defense from coyotes and such animals. We want to be clear and distinct about the different animals we are talking about.

DR. JOHNSON: I grew up in northwestern Minnesota and left that place about 1909. Coyotes and red foxes were abundant in that section of the state as far back as I can remember, at least I should say from 1890 on, perhaps earlier.

PRESIDENT WITMER STONE, presiding. Presentation of paper entitled·

THE CONTROL OF THE COYOTE

By W. C. Henderson

Associate Chief, Bureau of Biological Survey, U. S. Department of Agriculture

Before presenting my paper I would like to present on behalf of Mr. Redington his regrets that he could not attend this meeting. He had planned to do so but found at the last minute that pressing work in Washington would prevent his leaving town in time to be here today. I know that he is very sorry. Personally I am glad to be able to be here as his representative. I think perhaps no one has had more interest in this organization than I have ever since its inception. I believe that I can almost claim my home as its birthplace. The last preliminary meeting as I recollect, of those interested in the formation of this Society was held at my house, and I think at that time the committee was appointed which later resulted in forming the Society.

The oldest records of ancient man show that from the beginning he had to engage in a never ceasing struggle with other forms of animal life. The flesh of fishes, birds, and easily killed mammals furnished his food, and their skins provided his clothing. Some of his earliest art was expressed in the manufacture of weapons to defend himself against the attacks of the ferocious beasts of early times. Through collective action he learned to overcome animals that he could not cope with and kill single-handed. Of all the animals engaged in the universal struggle for existence he was merely the most intelligent. He lived in a hard world, and its fundamental law decreed that one must either destroy or be destroyed.

As man has advanced in civilization, other traits than those of ruthless self-interest have developed, and with this advance have come gentler qualities, including that of mercy, with an abhorrence of cruelty and a desire to avoid the needless taking of life. These qualities have resulted in a growing interest in living forms of all species and lead many to urge that man greatly curtail his interference with his neighbors of the wild. Notwithstanding this, the inevitable struggle for existence continues. In some parts of the world there is still to-day very real danger of attack by some of the larger forms of predators. Everywhere disease-carrying animals must be destroyed, whether they be protozoans or rats and other higher forms. Other animals also must be reduced in numbers when they take too large a toll of those forms, both domestic and wild, that are needed by man as food, or when they destroy the edible plants raised by man for his own use. Furthermore, action must be taken against those species that compete too strongly for food with

man's domestic animals, as when native and introduced rodents reduce seriously the forage on pastures and ranges or in storage.

Wherever throughout the world wild life abounds, man is compelled to wage continuous warfare against those kinds that are harmful. A recent article in the popular English journal "Discovery" (vol. 11, no. 124, April, 1930) lists some of the forms that, left uncontrolled, would drive man from the regions in which they flourish. The aggregate amount that has to be expended each year throughout the world in attempts at control along these lines is enormous.

The teeming abundance of wild life was one of the most conspicuous and important features of this country in the early days, though the original population has been sadly reduced. The harmless creatures, especially deer, that at first were a most important source of food, were later taken for sport without thought for the future, and now only a remnant of the former hosts remains. The fur bearers also were taken for their pelts as the trappers, traveling far and wide, explored the continent and blazed the trails for the pioneer settlers of the new country.

In the eastern part of the United States the presence of the larger forms of predators was nowhere tolerated near human habitations. Bounties were placed on their heads to encourage their destruction, and the hand of every man was raised against them. As the country has become more thickly settled they have been almost entirely eliminated over a large part of their former range. Many sections of the western part of the country, however, remain sparsely populated, and conditions there with respect to predatory animals are now in some respects comparable with the conditions that existed in the East a century a more ago. Moreover, it is probable that the larger forms of predators have always abounded in the western country in greater numbers than in the East.

The investigations by the Biological Survey of the wild-life of the West have included for nearly half a century studies of the economic relations of the animals found there. The destructive habits of the rodents have been observed and methods of control developed. The struggles of the stockmen and the farmers against predatory forms also were noted. Some studies were conducted of the food habits of these animals, though few comprehensive investigations along this line were made in the early years of the Survey's work. It was noted that the coyote, though hated by the stockmen, preyed upon rodents, many of which in turn were destructive of the farmers' crops. More importance was then attached to the rôle of the coyote as a factor in limiting the abundance of the harmful rodents than was found by subsequent investiga-

tions to be warranted. Doctor Fisher at first emphasized the value of the coyote in rodent control, though subsequently he became convinced that this animal was the most destructive of all the western predators. Another member of the Survey, detailed to make a field study of the coyote in Nevada, began his investigations in the winter, the season when rabbits were the principal food of the coyote in the areas visited, and from his first observations was almost prepared to make a favorable report upon the coyote's food habits. Later in the season, however, when, with the disappearance of the snow, it became more difficult for the coyote to capture these rodents, he saw how it turned to the domestic herds of sheep and noted the serious losses it occasioned, especially among the young lambs.

Members of the Biological Survey having the widest experience in the study of wild-life conditions in the western part of the country, including such outstanding naturalists as Dr. E. W. Nelson, Dr. A. K. Fisher, Major E. A. Goldman, and Vernon Bailey, have reached the conclusion that in most localities the destructive habits of the coyote far outweigh in importance any good that this animal may accomplish in its destruction of rodents.

In 1915 Congress made the first appropriation of funds to be used by the Biological Survey in the control of predatory animals. According to the best figures obtainable by the Bureau at that time the annual losses sustained by the livestock interests in the West through the depredations of predatory animals exceeded twenty million dollars. Rabies was then widespread among coyotes in a number of the Western States, and rabid coyotes had not only caused heavy losses among livestock but had also transmitted the disease to thousands of human beings, many of whom died.

When the funds were first made available for predatory-animal control the Biological Survey decided that the best plan of operation was to organize the western part of the country into districts and to place a competent man in charge of each district to direct the work of skilled hunters and trappers to be employed on a regular salary. Studies had previously been made of the effectiveness of the bounty system in those States where it had been used for the repression of predatory animals for many years. From its investigations of this subject the Biological Survey was of the opinion that predatory-animal control by the bounty system was unsatisfactory and ineffective. Not only had the bounty system been the basis of much fraud, but it had generally failed to accomplish its purpose. Many States had spent enormous

sums over long periods, and still the predatory animals were not noticeably reduced in numbers. Bounty hunters carried on their operations where the animals could be most easily obtained, regardless of whether serious damage was being occasioned to livestock. Even in regions where heavy losses were being sustained by the stockmen and the ranchmen, the bounty hunter as a rule took only those animals that were most easily caught, as it was not profitable for him to devote the time necessary to capture the most cunning and destructive of the predators. In any event he was loath to take more than the annual crop, as to do so would put an end to his business.

When the Survey first undertook the control of predatory animals, and for some years thereafter, the principal reliance was placed on the use of the trap in taking coyotes, although the animals were also killed in their dens and shot whenever it was possible to get within range. Poison was used to a limited extent. It was found, however, after several years' experience, that it was not practicable to control the coyote by trapping. The further use of poison was considered, and studies were made to develop a means of using a special poison that would be effective upon the coyote and would not result in the destruction of any considerable number of the smaller flesh-eating animals.

The use of poison for the destruction of predatory animals had been common in the West from the time of the settlement of the country. In some sections it was the practice of some to carry strychnine with them, and when they came to a dead animal, to poison the entire carcass and leave it there without any thought of its possible effect upon carnivores in general.

Such a promiscuous use of poison in its work was not considered by the Biological Survey. Poisoned carcasses or parts of carcasses are used to some extent by the Biological Survey where they may be placed without danger to the smaller fur bearers, as for example in sheep driveways and on the tops of bald hills remote from the habitat of the smaller animals. After much experimental work the Survey adopted the poison station method, which is the one commonly employed. This method consists in placing in a coyote runway a large piece of unpoisoned meat, known as the station, near which are placed a number of small poisoned fat baits. The fat commonly used for baits is beef-flank fat, horse fat, burro fat, or pork tenderloin fat. Exposure to direct rays of the sun in a few days time often breaks these fats down, making them unattractive, and therefore not effective. This is why such fats are used, as they form an essential safeguard when the station is abandoned, and all remaining

baits are picked up by the hunter. If a few baits are overlooked they present no danger as potential poisons for killing fur bearers and other forms of animal life. The poisoned baits are placed with reference to the unpoisoned meat, in such manner that a coyote, attracted by the scent of the meat but still suspicious and circling at a distance, will find the poisoned baits. The dosage of processed strychnine employed is such as to kill the animal as quickly as possible before it has time to leave the vicinity.

The poison station is placed at a distance from water and timber and out of higher mountain regions where the smaller fur bearers are known to be abundant. Poisoning is done at times on the so-called desert regions of the West seldom visited by such animals as minks, martens, fishers, and others. Unfortunately, however, the poisoned baits are sometimes taken by other flesh-eating animals, including skunks, badgers, and foxes. The aggregate number, however, of these smaller animals thus destroyed has never been large, and although it is deplorable that any should be killed the numbers so taken have had no appreciable effect upon the abundance of the species.

Furthermore, when compared with the enormous numbers of such animals taken by trappers, those killed by the Biological Survey hunters are relatively few. For example, during the past fiscal year, throughout the West the Biological Survey, according to the reports of its field men, while taking 40254 coyotes destroyed by trapping and poisoning the following numbers of small flesh-eating mammals: Badger, 1,465; civet cat, 17; fox, 513; marten, 1; mink, 8; opossum, 68; raccoon, 86; skunk, 649; weasel, 68; these make a total of 2,875. There are no statistics to show how many of these animals were taken by private trappers throughout the United States. Official reports of the annual catch of fur bearers have been obtained from several States, of which the following may serve as illustrations:

In Arizona, it is estimated by State authorities that during the fur season 1929–30 there were taken 35,000 foxes, 6000–7000 badgers, and 12,000 to 15,000 skunks. In Kansas, during the year 1929, the State authorities report that there were taken by trappers 269,000 skunks, 24,000 raccoons, 9,000 badgers, and 7,000 minks. In Idaho, while detailed figures are lacking as to the number of fur-bearers trapped, the aggregate value of the fur taken in 1929 was placed at $1,500,000, and more than 1,600 licensed trappers operated in this State alone.

As a further basis of comparison, attention may be called to the fact that at a single sale of skins of fur bearers at Seattle, Washington, in April, 1929, the following numbers of small skins were offered:

Mink, 8,267; red fox, 5,239; marten, 1,433; badger, 1,032; raccoon, 334. And at a single sale held in New York in May, 1929, the following skins of small fur bearers were offered: Badger, 15,969; gray fox, 24,182; red fox, 13,382; mink, 27,724; raccoon, 69,641; skunk, 273,404.

It has been stated that the reports of the Bureau's field men are not accurate, first, because when small flesh-eating mammals are found destroyed they are not always reported; and, second, because many of those destroyed do not die in the vicinity of the poison station and thus are not found.

As to the first point, it may be said that it is the duty of our hunters to report all such animals, and when taken during the fur season by coöperative hunters, the proceeds in many States are available for further work. Moreover, the operations of the field men are checked by leaders who would not hesitate to discharge an employee who made false reports to the Bureau.

As to the second point, it should be borne in mind that the dosage sufficient to kill a coyote is much more than that required to kill one of these smaller animals. Consequently, death occurs in a shorter time in the smaller animals and these are usually found closer to the poison station than in the case of the coyote. Our experienced field men are of the opinion that smaller animals when poisoned seldom go far from where the poison baits were placed. Furthermore, these smaller animals are usually not so suspicious as coyotes and are more apt to proceed directly to the unpoisoned meat to satisfy their hunger.

In other words, the reports of our field men are not only made as a matter of duty but they are reasonable in view of all the circumstances. Nor are these hunters, as has sometimes been said, irresponsible and underpaid. They are the most reliable men that we can employ, they are selected as a rule from among the residents of the region where employed and they are paid a fair wage, varying usually from $125 to $175 per month.

Reports are sometimes published, and receive wide credence, to the effect that martens or some other small animals have been completely eliminated from certain regions by the poisoning operations of the Survey. Such stories have been repeatedly investigated by the Bureau and found to be without basis. Indeed in many cases no poisoning operations had been conducted by the Survey in the region mentioned. As a matter of fact there are vast areas throughout the Western States where no poison has ever been used by the Biological Survey, and where coyotes still abound.

The great diminution in the number of fur bearers of the West has been caused by the settlement of the country, by over-trapping induced by the high prices that have been paid in recent years for furs, and by the uncontrolled use of poison by thousands of individuals, many of whom give no thought whatever to the effect of the poison upon the general wild life population. If the Biological Survey should discontinue the use of poison in its predatory animal work in the West, poison would nevertheless continue to be employed by others for this purpose, and the result of its uncontrolled use upon wild life might well be disastrous.

The whole subject has received the serious consideration of Mr. David C. Mills, General Director of the National Association of the Fur Industry, who by correspondence and personal interview has obtained information from many reliable sources. At a recent hearing before the Committee on Agriculture of the House of Representatives Mr. Mills submitted a statement, from which the following is quoted:

> I do not like the work of the Bureau in controlling predatory animals. This is, no doubt, because I am not a sheep man and object to the curtailment of the supply of coyote skins for the benefit of the sheep men. But I believe the conduct of this work by the Bureau is infinitely preferable to the indiscriminate use of poisons by sheep men.
>
> Opponents of the Bureau, whether fur men or scientists, seem to ignore two very important points, i.e., (a) that coyotes must be kept under control, and (b) that private poisoning is far more dangerous to wild life than poisoning by Government employees.
>
> I have no doubt that if coyotes are not kept under control they will multiply and spread all over the United States, carrying rabies everywhere, destroying livestock and poultry, and even depleting the supply of other fur bearers.
>
> Prior to the Klondike rush we found few if any coyotes north of the Canadian border. Now we find them on the shores of the Arctic Ocean at the mouth of the Mackenzie River, whence they have drifted westward into Alaska. As they have advanced in Alaska one trading post after another reports the decline in the catch of Alaska red fox. Inconsistent though I may seem, I had to appeal to the Committee on Agricultural Appropriations some time back for funds for the control of coyotes in Alaska for the benefit of trappers and fur traders there.
>
> It occurs to me that the recession in the supply of desert foxes complained of in some parts of the southwest may be charged against the account of the coyote.
>
> The men engaged in coyote work have been under strict regulation. They are not wantonly scattering poisons hither and yon. They are held strictly to account.
>
> On the other hand private poisoners scatter poisons as if they were hand-sowing wheat. The way they are doing it in sheep country is disgraceful and no doubt highly destructive to wild life. Furthermore, I venture the assertion that there are twenty private poisoners in sheep country to one Government poisoner, and none of the private poisoners are under any restraint whatever.

The up-shot of the whole matter will be that by the time the coyotes are exterminated there will be no other wild life unless it be some of the birds and reptiles.

My feeling is that while the Government has no jurisdiction over coyote poisoning it can and should exert its influence to curtail such activity. The Government can refuse to coöperate in this work where private and uncontrolled poisoning is permitted.

My own inquiries indicate to me that the damage done by Bureau agents to the fur supply is negligible, but that the damage done by private poisoners, principally sheep men, is enormous.

I trust that the work of the Bureau will continue without interruption but that a means may be found to check private poisoning.

One other point should be borne in mind in the consideration of the use of poison in the control of coyotes: The use of poison by the Biological Survey, although very much more effective at certain times of the year than are traps in controlling the coyote, has not in the opinion of the leaders of the work resulted in killing an appreciably larger number of the smaller flesh-eating mammals than would have been destroyed if traps alone had been employed. If only traps were used in the Bureau's work, many of the smaller animals would unavoidably be captured, although it is the practice of the Survey to release such trapped fur-bearers when they are not seriously injured. It is the opinion of experienced field men who have used and are using both methods at the present time that it is more difficult to avoid taking the smaller fur-bearers with traps than is the case with carefully placed poison stations.

The poisoning methods employed by the Biological Survey have proved to be effective in checking the depredations of the coyote in regions where operations have been carried on. Much has been accomplished in reducing the losses to livestock in these regions. We have not been able, however, to conduct control operations in all sections of the West where serious losses are being caused by the coyote to livestock and poultry. We have not been able, through lack of available personnel, to meet many calls for assistance; nor have we been able to extend our work into some of the Middle Western States where predatory animal control is needed.

Our poisoning campaigns have resulted in a local reduction of the numbers of coyotes, but it is doubtful whether the coyote population has been materially reduced throughout the Western States as a whole. It is the belief of many familiar with the situation that the number of coyotes taken by the Survey scarcely equals the annual increase. This belief is borne out by the fact that during the fiscal year 1929, after the

Survey had been conducting the work in the West for fourteen years, more coyotes were destroyed than in any previous year.

Soon after the predatory animal work of the Bureau began, Dr. E. W. Nelson, then Chief of the Bureau, determined to make a comprehensive study of the food habits of the coyote and other predatory animals. He was of the opinion that examinations should be made of the stomachs of all animals taken. The only way in which this could be accomplished was to have the examinations made in the field. If he had depended upon laboratory studies only a limited number of stomachs could have been examined with the means at his disposal. It seemed to him far better to have the hunters themselves open up the stomachs of all predatory animals killed or captured. He was of the opinion that these men were capable of doing the work and that the results would be at least 90 per cent accurate. Consequently, all hunters in the employ of the Biological Survey were required to examine the contents of the stomachs of animals taken and to report their findings to the Bureau. This study continued for more than 10 years and involved the examination of tens of thousands of stomachs by hundreds of field men operating throughout the entire West. Many stomachs, especially of animals trapped, were found to be empty, others contained material that could not be determined, but the majority contained food material that was readily identified.

The hunters, although not trained scientists, were familiar with the common animals of the region where they were employed. While not always able, perhaps, to determine the exact species of the animal the flesh of which was found in the coyote's stomach, generally they had no difficulty in recognizing the flesh of game, domestic livestock, rodents, and other mammals forming the food of the predators. With their knowledge of local conditions, they had one advantage over a laboratory worker at a distance: They were in a better position to recognize bait and carrion, and their reports show that this was taken into consideration.

The examination of a coyote stomach is hardly comparable with the examination of the stomach of a small bird, where minute fragments are often found that can be identified even by the trained worker only through the use of the microscope. A large flesh-eating animal like the coyote bolts its food, and large pieces of flesh, often with pieces of skin or with the head or feet of small animals attached, are found and can easily be recognized in the field.

The value of a field examination of the food of predatory animals was

fully recognized by Mr. Joseph S. Dixon, who, some years ago, conducted a study of the food habits of some of the predators of California. In the study of the coyote, he was assisted by field examinations conducted by 39 trappers, who were taking animals in various parts of the

TABLE 1. STOMACH CONTENTS OF COYOTE, 1919–1923

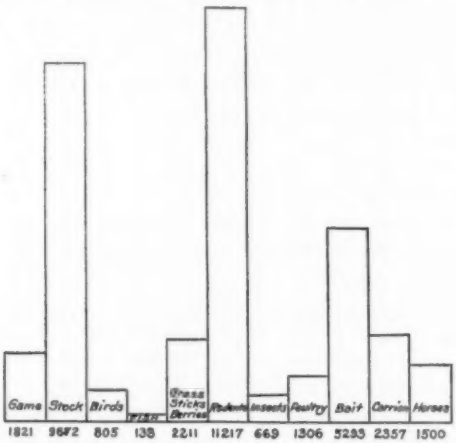
FOOD	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	TOTAL
Beef	290	195	122	122	157	152	167	229	257	337	278	211	2,517
Horse	228	181	146	90	80	48	46	55	103	142	184	197	1,500
Sheep or goat	411	275	243	345	769	664	741	806	851	842	636	363	6,946
Pork	12	12	16	5	24	5	11	29	21	19	30	25	209
Poultry	46	41	21	38	86	91	141	224	221	189	143	65	1,306
Grouse	50	26	31	33	109	159	188	222	177	154	59	60	1,268
Waterfowl	2	1	1	4	4	39	3	7	14	9	6	4	94
Other birds	60	28	48	31	38	43	133	157	94	79	62	32	805
Deer	32	49	19	41	39	25	40	35	18	51	34	16	399
Elk	1	3	0	4	2	1	0	0	0	3	5	1	20
Antelope	3	16	0	1	3	2	4	1	1	2	4	3	40
Rabbit	674	424	290	302	554	484	587	989	1146	1179	723	577	7,929
Ground squirrel	6	9	49	93	189	229	218	218	59	44	28	6	1,148
Prairie dog	3	13	9	18	36	66	103	114	101	77	24	20	584
Chipmunk	1	3	4	2	1	2	11	17	15	7	1	1	65
Groundhog (marmot)	0	0	1	6	14	11	13	15	4	0	0	0	64
Mouse or rat	102	77	35	63	88	74	82	191	250	233	118	114	1,427
Bait	955	752	502	365	171	96	169	235	441	398	484	725	5,293
Carrion	195	193	175	102	154	132	145	253	248	347	234	179	2,357
Insects or worms	3	0	1	30	6	37	115	231	185	40	16	5	669
Fish, frogs, reptiles	3	1	1	3	10	22	21	44	19	6	5	3	138
Grass, sticks or berries	93	51	38	83	105	126	240	378	468	349	165	115	2,211
Totals	3170	2350	1752	1781	2639	2508	3178	4450	4693	4507	3239	2722	36,989

State. In defending the results of their findings, in an article published in the February, 1925, issue of the Journal of Mammalogy (vol. 6, no. 1, p. 37) he stated as follows:

> My laboratory work has been checked against the examinations made by trappers in the field and the two coincide quite closely. If all the stomachs were examined by one man, it might be claimed that he was prejudiced for or against

fur-bearers. However, where there are 40 or 50 men distributed over a large State, each working entirely independently of the others and all get similar results, we can not well doubt the significance of their findings, especially when the trapper's findings check so closely with examinations made in the laboratory.

His reasoning is sound. If, therefore, the results of the extensive field examinations conducted by the employees of the Biological Survey are similar to those obtained by Mr. Dixon in his study of the coyote,



Record of about 30,000 coyote stomach examinations made by Biological Survey hunters 1918–1923.

FIG. 1

we must conclude that the investigations carried on by the Biological Survey were made with reasonable care and that they can not be disregarded. A summary of the results obtained by the Biological Survey for the five years ending 1923 is shown in table 1. This covers approximately the same period during which Mr. Dixon conducted his work in California. It will be noted from an examination of this table that horse meat, which was very generally used as bait material, is reported separately; also, that a large number of items were reported as bait or carrion.

In figure 1 is shown graphically the result of this five-year study.

It will be noted that the flesh of rodents constituted the largest single item of food found by the Biological Survey hunters in the stomachs of the coyotes taken. It will be noted also that the aggregate of domestic livestock, poultry, and game exceeds the rodent item. Mr. Dixon, in his

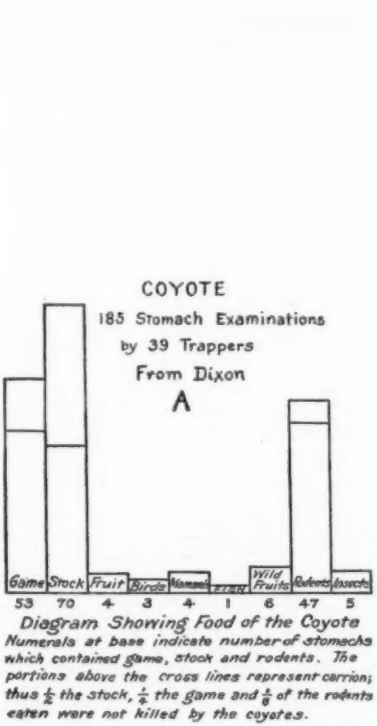

COYOTE
185 Stomach Examinations
by 39 Trappers
From Dixon
A
Game
Stock
Fruit
Birds
Wild Fruits
Rodents
Insects
53 70 4 3 4 1 6 47 5
Diagram Showing Food of the Coyote
Numerals at base indicate number of stomachs which contained game, stock and rodents. The portions above the cross lines represent carrion; thus 1/2 the stock, 1/4 the game and 1/6 of the rodents eaten were not killed by the coyotes.

FIG. 2A

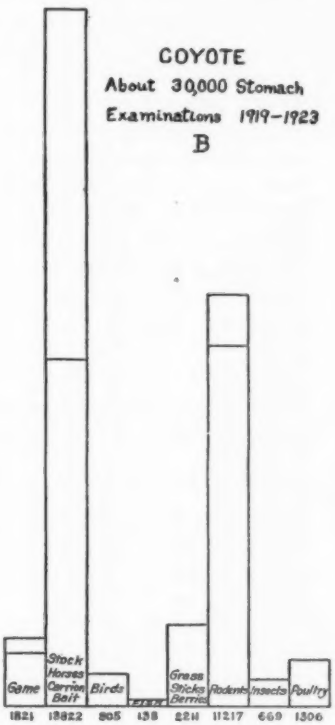


FIG. 2B

article above referred to, published a graph showing the results of his investigation. He did not show separate items of bait, carrion, and horse meat, but rejected a percentage of each of the principal items of food to allow for bait and carrion.

There is presented also a graph (fig. 2 A) that was prepared by Mr. Dixon, and also a graph (fig. 2 B) prepared in the same manner showing

the results of the five-year study by the Biological Survey. In the Bureau's graph, bait, carrion, and horse meat have been added to the item of domestic livestock, and a reduction in this item and in the other principal items has been made, using the same percentage as that employed by

TABLE 2. STOMACH CONTENTS OF ABOUT 50,000 COYOTES, FROM FIELD REPORTS. FIVE YEAR PERIOD—1924–1928 (INCLUSIVE)

FOOD	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	TOTAL
Beef	216	242	162	151	208	132	101	127	209	236	261	194	2,239
Sheep or goat	524	351	455	477	1130	950	697	992	1059	1098	825	521	9,079
Pork	41	14	18	19	27	11	26	23	61	55	44	32	371
Poultry	94	75	76	66	262	250	252	385	428	415	264	138	2,705
Grouse, quail	148	146	133	123	218	404	275	334	268	219	156	147	2,571
Waterfowl	13	2	4	2	20	24	14	15	3	16	13	10	136
Other birds	44	49	43	38	79	88	140	150	93	104	99	55	982
Deer	97	129	86	95	65	63	52	85	97	165	152	123	1,209
Elk	9	9	14	16	1			2		7	1	13	72
Antelope	3	2	10	5	3	34	3	8		9	3	4	84
Rabbit	1069	774	648	540	1223	1043	715	977	1276	1524	1381	971	12,141
Ground squirrel	44	37	82	148	278	296	244	214	144	115	77	57	1,736
Prairie dog	4	11	20	31	32	44	66	80	87	67	46	23	511
Chipmunk		3	7	6	16	8	7	13	14	12	10	4	100
Groundhog		1	9	14	45	98	59	38	15	1		6	286
Mouse or rat	222	180	151	140	126	111	119	292	344	410	301	219	2,605
Insects, worms	2	1	3		21	28	85	197	130	54	18	3	542
Fish, frogs, reptiles	6	3	3	1	9	7	19	19	12	12	23	2	116
Grass, sticks, berries	92	61	70	120	119	154	252	586	662	618	263	141	3,138
Horse	528	405	301	150	42	48	33	76	121	351	484	471	3,010
Carrion	248	296	333	231	304	219	323	317	361	540	388	314	3,874
Bait	2179	1854	1221	405	147	71	122	317	521	994	1720	2112	11,663
Totals	5583	4645	3849	2778	4365	4083	3604	5247	5905	7022	6529	5560	59,170

Mr. Dixon. The close similarity of the net results shown by the two graphs is apparent. Closer results could hardly be expected, bearing in mind that Mr. Dixon's study was confined to one State, while that of the Biological Survey included all the principal stock-raising States of the West.

In each case the flesh of rodents constitutes the largest single item;

and in each case the aggregate of domestic livestock and game exceeds the rodent item. In other words, both investigations show that the coyote feeds more extensively upon domestic livestock and game than upon rodents. A summary of the results of the examinations of coyote stomachs obtained by the Biological Survey for the five-year period 1924–28, inclusive, is shown in table 2.

The actual economic status of the coyote, however, is not fully shown by the results of the Bureau's investigations inasmuch as coyotes are sometimes taken in regions where no livestock is found at that time of the year. It is the practice of the Biological Survey to conduct control operations on certain ranges when no livestock is present, in order that these areas may be relatively free of predatory animals when a little later the livestock are moved upon them. Consequently, the fact that the coyote has been feeding upon rodents does not necessarily indicate a preference for this variety of food. Moreover not all the rodents destroyed by coyotes are harmful. It should also be borne in mind that coyotes frequently kill animals that are not eaten. This trait, of course, can not be revealed by a stomach examination.

The Biological Survey is fully alive to the responsibility placed upon it in its predatory animal control work. It is its duty under Congressional action to afford relief to the stockmen and ranchers of the West from the heavy losses occasioned by the large predators. At the same time, its interest in the conservation of valuable and harmless wild life of all kinds is attested by its work in other directions. It has, therefore determined to make a more intensive study of the entire situation than has hitherto been undertaken. It had been hoped that a thorough investigation of our poison methods and the results accomplished would be made by Mr. Dixon under the auspices of the National Association of the Fur Industry. Every facility was to have been afforded Mr. Dixon in his work, and the Bureau's field men had been instructed to give him the fullest coöperation. It is regretted that this investigation has not proved feasible. A thorough study will be made, however, by trained naturalists of the Bureau as a basis for making any changes in methods that the facts may warrant.

The studies of the food habits of the coyote already conducted corroborate numerous field reports of damage, and have been regarded by the Biological Survey as reliable, and far more comprehensive than could have been obtained as a result of laboratory examination. Because of the importance of the subject, however, and in view of the feeling among certain naturalists that the field investigations should be

supplemented by studies conducted by trained men in the laboratory, the Survey has now decided, beginning the first of July, to supplement the work already done by further studies in both the field and the laboratory, to be conducted under the direction of Mr. W. L. McAtee, who for so many years has been in charge of the food-habits research work of the Bureau. It is planned to continue this study as long as may be necessary and to make it as thorough and as comprehensive as the Bureau's available funds will permit. Meanwhile it is hoped that funds will be available to make possible more detailed studies of the life history of the coyote, with special reference to its relation to other animals. It is planned to publish the results of these studies from time to time so that naturalists and others interested will be kept apprised of the progress made.

PRESIDENT STONE: Questions are in order on Mr. Henderson's paper.

DR. E. RAYMOND HALL: Mr. Henderson's paper contains so many mistakes that I know not where to begin. To be brief I should like to pick out five or six that appeal to me as obviously mistaken information.

For one thing Mr. Henderson has mentioned that the smaller fur bearers would be found in greater numbers than the coyotes about the poison stations because the dosages are larger, that is, the dosages of poison are larger for the small carnivores than for the large ones. One of your Denver men on the way out here told me they found that the larger dosages of strychnine did not kill animals as quickly as the smaller.

Point Number 2: We have in California a law prohibiting the use of poison. The Biological Survey has failed to coöperate with us, and as a result our authorities actually cannot for political reasons enforce this law, with the Survey and the sheep men against it. The use of poison by the Government is certainly a bad example to the numerous private individuals who admittedly do use it.

Point Number 3: About the agreement of Mr. Dixon's results and the Survey results, I happened to be present when Mr. Dixon was making his examinations and I think that the idea which has been given out here is somewhat erroneous. The results of the hundreds of Biological Survey examinations are similar to those of Mr. Dixon but that is all one can say, for some items vary as much as 50 per cent when they are analyzed carefully. They are far from agreeing.

Also, Mr. Dixon selected trappers who were trapper naturalists. He selected his trappers from among men whom he had known a long time, who as I say were in some cases more naturalists than trappers. They had no reason for reporting one kind of material more than another, whereas you must admit it is to the distinct advantage of the Biological Survey trappers to report domestic stock, irrespective of whether they do report it or not.

Another point: These figures which were presented here were explained by Mr. Henderson in this fashion: 'Of course, coyotes do not eat horses.' We know that. But those figures I understand have been used at other places to indicate that coyotes do eat horses, that horsemeat was part of the food.

Also, in the graph prepared from these figures, am I not correct, Mr. Henderson, in believing that cattle appear in the game column?

MR. HENDERSON: They are included in the domestic live stock column.

DR. HALL: Exactly. And of course it goes without saying that a large percentage of the cows reported in coyotes is meat from dead carcasses and from animals used as bait.

I am tempted to mention one other point about Mr. Dixon's investigation. We too regret that that could not have been made and I believe the reason given was that the money to be supplied by the National Fur Association was not forthcoming in full amount. I think there was some $300 if I am correct. Is that right?

MR. HENDERSON: I do not know anything about the [details of the] financing [except that the President of the National Association of the Fur Industry which was to provide the money notified the Bureau that the necessary funds could not be procured.]

DR. HALL: I think that is all that was left to be gotten. It is a fact well-known to us, and I feel certain to others, that if this investigation had been wanted there are many sources which would have supplied this small amount of money. That is all I have to say.

MR. HENDERSON: Mr. Chairman, on most of what Dr. Hall has said I haven't any comment to make but I resent that last statement. That attacks the good faith of the Biological Survey as conducted under Dr. Nelson. He did want that examination and so did I. It was never put up to Dr. Nelson, I am sure, that if he could raise $300 or any fund the thing could be put across. I never heard it before. I do not think it is fair to make such statements reflecting upon the integrity of the Survey without any basis or foundation whatever.

DR. HALL: I would retract any implication of unfavorable reflection on the Survey as such. I know that Dr. Nelson did wish that examination to be made. He told me so only two or three days ago, and arrangements were well under way when he left office.

PRESIDENT STONE: Are there any further comments on Mr. Henderson's paper?

MR. GOLDMAN: There is just one point I should like to comment on what Dr. Hall brought up about the effect of poisons. We all know, I think, who have used poisons, that it does not always work exactly alike on individual animals, and that a good deal depends on what the animal may have in its stomach at the time. If the stomach is filled the action is not so quick as it is otherwise. I have found in my own experience using poison that in a good many cases where the animal got a large dosage of poison, the poison was thrown up and the animal got away. At some distance away I found the poison thrown up and the animal got away entirely. That might happen in a good many cases with small fur bearers that get an overdose.

DR. SHADLE: There was one point that occurred to me while Mr. Henderson was reading his paper. He gave the number of animals that were taken, the small fur-bearing animals that were taken near these baits. To me it would be interesting to know the number of coyotes that would correspond to those same baits. Have you any figures on that?

MR. HENDERSON: Those figures that I gave, Mr. Chairman, were not limited to the animals taken around poison stations. They included all of the smaller fur bearers taken throughout the year by whatever means. Many of them were taken in traps and during the same year there were actually taken something over 40,000 coyotes, I believe. That is not counting those that escaped and were not recovered.

DR. SHADLE: And the other number was something over 2000 as I remember.

MR. HENDERSON: Yes.

DR. STORER: Mr. Chairman, this comment Mr. Henderson just made with regard to the initiation of work by Mr. McAtee and associates is very interesting. To me it has been rather difficult to understand why in sixteen years it has not been possible to do some of this work, and since Mr. Henderson is representing the Biological Survey, I am wondering if he can give us assurance, first, that a large staff will be put onto these examinations so that we can get information on the subject in a hurry; and second, that some of the stagnation in the publications of the Biological Survey can be cleared up, and if that cannot be cleared up whether we cannot have this information in mimeographed form.

I am willing to abide by the decision of a proper combination of field study and stomach analysis, but I do not want to take merely the information from either source. It would be very easy to sit in the laboratory and make mistakes in the diagnosis of material, as to whether it is bait or living animal. It would be very easy in the field to make mistakes in identification. Anyone who has examined stomach contents, I think, realizes that. I think some of the men in the field do not realize their deficiencies in that respect.

I urge upon the Biological Survey that they take every step possible to make this information available to us within a very short space of time.

DR. FISHER: I thought that Mr. Henderson made it very clear that the Survey was anxious to learn of the food habits and he spoke of Dr. Nelson's endeavor along that line. It would be very difficult in a careful examination in a laboratory to treat 15,000 stomachs. Mr. Hall left the impression that the men in the field may have a tendency to favor livestock men.

I do not believe that it will be practicable to put a large corps of men in the field for scientific study, but I believe it is the intention to have one or two men who will cover the ground pretty thoroughly, not in one year, but in a certain time.

MR. HENDERSON: Mr. Chairman, I might just say a word on that: In the beginning it will not be possible, no matter what our desires may be, to start on

a large scale. We have not the trained workers to do it. That is, we have not enough of them. We can not take everybody off of the work upon which they are now engaged and put them on any one project. We have to handle this as best we can, with the more or less limited number of men we have. Also at the present time it will not be possible to state just how much money we may have available for the project. The appropriation bills for next year have not yet been passed, but it is the intention of the Bureau to make a really serious study of the subject under McAtee's direction, and to back him up as far as it may be necessary.

PRESIDENT STONE: The time is very short and I think that we will have to pass on to the next paper on:

RATIONAL PREDATORY ANIMAL CONTROL

BY DR. CHARLES C. ADAMS

New York State Museum, Albany, N. Y.

Before reading a very brief paper, I wish to make a few personal remarks. This subject of the control and preservation of predatory animals has been agitated by this Society for five years and it is one which has produced much heat but a comparatively small amount of light. [Laughter.] That has been evident every time the subject has been discussed. There has been so much confusion that I think it is very desirable to clear up certain points in advance. What I have to say is not simply my own opinion, for I have talked with dozens of members of this Society, scattered in all parts of the country, from the Atlantic to the Pacific, and I notice that there is a certain uniformity of opinion. That does not mean that they all have the same views, but there are certain points which they consider as fundamental and on which they agree.

First of all there seems to be no question but that the Bureau of Biological Survey is compelled to carry on a big killing campaign of predators. There is no question about that. After I gave my paper at the Cambridge meeting of the Society [Jour. of Mammalogy, Vol. 6, pp. 83–96, 1925] and stated definitely my stand for control and for conservation, I was accused of being opposed to all control measures. This is of course not true. As I understand the members of our Society they do not oppose rational control, and yet do not favor some of the prevailing policies of the Bureau of Biological Survey, particularly the extermination policy for the large predators. It will not suffice to put up a straw man and claim that everyone opposed to certain unrestricted Survey policies is opposed to killing when necessary. This course only causes

confusion. The impression is very general that while there have been hundreds of thousands of dollars available for destruction, there have been only a few thousand dollars used for scientific studies, not only of their food, but for every other aspect of the problem. The fact that there was no money available may be the whole explanation, but that point has never been adequately brought out. The Bureau has simply defended its policies. I imagine that there is something in the background that we have not been told at these meetings.

We know that there is an agricultural depression in the West. We know that during the War there was over-production in agriculture and that it also included domestic animals. Everyone knows that the western forests were severely overgrazed. The head of the Survey now is a man with Forest Service experience and has dealt with these grazing animals for years. He knows that phase of the problem. The overgrazing in the West has been a terrible menace to the grazing lands of the National Forests and of the Public Domain [cf. Adams, Sci. Monthly, Vol. 20, pp. 561–593. 1925].

After the War, when the depression became acute, the grazing interests went to the U. S. Forest Service and demanded certain special privileges, including remission of grazing fees, but the Service met this opposition with a powerful organization which informed everybody in the United States what the cattle and sheep interests in the West were after, and with the help of the foresters and the public the National Forests were protected. No one has come to the meetings of this Society and told us about this political machinery and what it involves in the case of the predators. There was risk that in a week a bill might abolish the Bureau of Biological Survey. That might happen, as it was once before threatened many years ago. These are aspects of the problem that I think we must bear in mind, and, I think, ought to be understood here in the Society. Of course if that is the situation of the Survey men, if they do not agree with the policies of the Bureau they can say nothing except at the usual risk. It is their bread and butter. We might as well have these things clearly understood. [Laughter.] I think that will explain a number of the criticisms; a number of people are not free to talk. They do not agree with the policies but are not in a position to speak. [Laughter and applause.]

This is why I think that some plain talking is necessary before we can get through with this matter. We have battled for five years and we have gotten no satisfactory response to the major things for which we have contended. We claim that the Bureau should come out with a de-

finite policy, state it plainly, publish it with the data in a bulletin of 100 or 200 pages, and give us something constructive. Little pamphlets of a few pages will get us nowhere. When the Bureau considers other technical subjects we get substantial publications. I do not see how this Society can take any other stand than to insist that the Bureau of Biological Survey come out in all sincerity and state its case.

This evasion by the Survey is the basis for the present situation; we have been put off repeatedly. I now hope that the promised plan to begin, seriously, a truly scientific study of the predatory problem will be put through, but it should not be limited solely to the food of the predators, it should include every aspect of the subject.

That the Joseph Dixon plan for the study of the relation of predatory animal destruction to fur-bearers fell through, for the lack of the sum of $300.00, shows that it lacked sincere support. It is such experience that causes a lack of confidence in the seriousness of the Bureau's efforts. There has been a lack of confidence that cannot be camouflaged. There is no question about that. There are dozens of members who look at this just as I do. That is one thing that should be told here by someone. No one else has, so I am doing it.

I have another statement to make. I want to call the attention of everyone in this room to this publication [holding up the volume]. You have heard this morning two able defenses [by Henderson and Goldman] of the Bureau's policies. You will get a fine amplification of the same sort of thing very frankly stated in this book by Jenks Cameron: "The Bureau of Biological Survey, its History, Activities and Organization." It is published by the "Institute of Government Research" in Washington (now the Brookings Institution). This Institution was organized to study the administrative phases of the Government. They have published a whole series of monographs on various bureaus. These are supposed to be purely descriptive but they discuss various policies as well to some degree. About half of the volume on the Bureau, or 150 pages, is devoted to the history of the Survey. There is a full account of their publications and an excellent summary of their appropriations.

There are a few points which you ought to be told at this time, as you may not have the book on your table. On the first page it states that the Bureau is: "A governmental agency that takes a leading, if not the leading, part in American wild life and game conservation, and the repression and extermination of predatory and other undesirable species." Here is the *extermination* policy. The book is dated in 1929. We

have been assured officially (September 1, 1928) that extermination is not the policy. [Laughter.] I cannot harmonize these statements. [Laughter and applause.] This is only a drop in the bucket [laughter], for the author continues: "In recent years, however, there has developed considerable opinion to the effect that the nation's predatory animal policy is a nibbling policy that is uneconomical in the long run; that it would be better to go at the problem on a grand scale for a period of years, and finish it up once for all—so far as that might be humanly possible—than to string along in the present fashion of just about keeping up with the annual increase."

I wish to indicate that it is not simply an accident that the word "*extermination*" slips in. More than once I find statements of that order. I wish to turn to one more. It tells about the destruction of the large predators and continues: "The best gauge of the success of the work is its measure of accomplishment. Predatory animals in the great stock-raising areas of the West have not been exterminated. . . . . It is now pretty generally agreed that the end of the wolf is in sight. . . . . In a general way, similar comment may be said to apply to the cougar (or mountain lion), the lynx, and the bobcat. Their depredations have been controlled, and their ultimate elimination, though not so apparently imminent as that of the wolf, is only a matter of time. The coyote has been definitely checked but still exists in numbers, and his complete extermination, it is safe to say, lies a long way in the future."

I wanted to bring out these statements to show again that it is not an accident that the word "extermination" is used; this is the term emphasized, as it seems necessary to describe the actual work. The members of the American Society of Mammalogists have right along opposed this extermination policy, and feel that the Survey should have some constructive policy as to where in a country as large and as wealthy as this, something can be done to preserve some of these larger predators. As has been said, we have no positive contribution from the Survey on this after five years of discussion.

I recall the discussion at the Philadelphia [1923] meeting of the Society, when Mr. Goldman spoke of the extermination of the mountain lions in the Kaibab Forest. I asked him if they were killed off there—where there is an excess of food—where might they be preserved? He replied, in the Yellowstone National Park. I then asked him how many there were in the Yellowstone but he did not know. Later an effort was made to get an estimate of the number, and M. P. Skinner, who had lived there about 25 years, estimated that there were about a dozen [cf. Skinner: Roosevelt Wild Life Bull., Vol. 4, p. 180; 1927].

I think that we can afford to have mountain lions somewhere in America besides stuffed specimens in the museums. If we were a poor country and did not have millions of dollars that we waste on trifles, we might say, "We cannot afford a few mountain lions." But we are probably the richest nation on earth, and what would be the cost of maintaining one hundred mountain lions in North America? Would it stagger American civilization? We have millions of acres in National Forests, in the Public Domain, and in the National Parks. Some of the areas could be managed in such a fashion that some of these animals could be preserved and eat deer meat! Why shouldn't they? We grow reindeer and other animals and ship them to the cities for overfed men who could just as well eat beef! Who will deny that America is able to support reservations where some of these remarkable animals can be preserved?

This is the sort of thing for which the American Society of Mammalogists has stood and for which it has been condemned. Various members urging such measures have met with all sorts of accusations and personal misrepresentations and abuse. Pressure has been applied in various ways, even down to ridicule, because of the insistent demand that the *scientific studies* precede *wholesale destruction* and *extermination*.

Now I am ready to read a joint statement with my colleague, Alvin G. Whitney. It is brief, but I have wanted to insert this preface because there has been so much confusion and quite a little abuse. This statement is in the form of a telegram, which we sent to Washington when the Congressional budget hearings were recently called [H. R. 9599, Serial O.], as follows:

"As field naturalists of many years experience, including work in the West, we strongly protest the excessive expenditure of public funds for drastic reduction of predatory animals in advance of satisfactory proof of the soundness of that policy."

DR. ADAMS: What is the matter with that?

MEMBER: It's all right. [Applause.]

DR. ADAMS: Am I alone in this kind of statement? Some people have tried to make you think I was the only one that believed that statement.

"Elimination of these animals is almost certain to be followed by excessive increase of mice, rabbits and other rodents, comparable to the rabbit plague in Australia. This will necessitate continual appropriations for the Government poison squad. The present costly program

has no assurance of success. We urge provision for comprehensive scientific study *first*, as the only basis for intelligent control."

PRESIDENT STONE: Discussion is in order.

DR. FISHER: It depends a good deal upon who talks. Why does not the East help the West in keeping the mammals in existence? Right in this state, in the county of Orleans, they went into hysterics because a few coyotes went in there, and they paid $10,000 to get rid of them. Why did they not keep them there? And I remember when Dr. Nelson suggested to Dr. Adams that a few wolves might go into the Roosevelt Reserve here. I do not think the Biological Survey is afraid to talk. It is meat. Meat is the regular food. What is the difference between an Englishman and a Chinaman except meat? (Laughter.) The Englishman went over the world and made it better for civilized people because he is a meat eater, a beef eater. Now we are running short of beef and it is our duty to save all the beef and mutton that we can.

Is there anyone who wants to pay seventy-five cents or a dollar a pound for steak? If we kill off those things which are destroying our meat, we will have more meat for our increasing population. We are now a population of about 130,000,000 and our supply of meat is going down each year. We should have more meat and the only way that I know of getting it is to save it, and if necessary in certain places exterminate the destroyers of it, the same as they did in Orleans County.

It is impossible to exterminate the coyote; the same is true for the red fox. The red fox goes right into Washington, right into the suburbs. I have seen the tracks. The coyote goes right into Denver. I know where they kill pheasants and eat them in the parks of Denver. There will never be a time, during the period of our lives at least, when the coyote or the red fox will be exterminated. And when Congress gives the Biological Survey orders to do a certain thing they are going to do it, to the best of their ability.

DR. ADAMS: Mr. President, I just want to add a word. The reaction of the previous speaker is typical of what has been criticized. Nobody has said they did not have to control them. I said that on purpose, to handle such cases as you bring up. The control must go on. Nobody is opposing that. They must do it. We ask for a certain kind of intelligent control. It has to be done. Nobody is opposed to having the stock and to getting meat at a reasonable price. Of course, the tradition is that he is the man who has been one of the ring-leaders in this trouble. (Laughter.)

DR. FISHER: I should like to know just how carefully all these men who are opposing this have been over the Western United States. In the last thirty years I have gone over half a million miles and I would like to be told just where it would be convenient to put mountain lions or wolves. I am just as fond of wild animals as anyone but when they come up against man we have to do certain things for the benefit of man.

Along this same line, a man about thirty years ago wanted to put the hippopotamus and rhinoceros in America, to furnish more food. He wanted to put the hippo-

potamus along the Gulf of Mexico, in Louisiana. He said it would eat up the water hyacinths. I asked him if he knew that. He said, "No," but he thought it should, the same as we thought the sparrow could be trained into eating worms, although the English and others told us they never would. And he wanted to put the rhinoceros in Arizona. I asked him whereabouts. "Well, anywhere," he said. He thought he would put them in the Tonto Basin where the buffalo were. I told him he would have to put shoes on them to keep them from slipping off the cliffs. And the hippopotamus, I reminded him, was slightly nocturnal and went eight or ten miles inland, and I wondered what the Louisiana sugar cane people would say when they found a little drove of eight or ten hippopotamuses in their sugar cane.

If you can tell me, where in the West it would be safe to put mountain lions or wolves I would like to know where it is, because a wolf will travel one hundred miles, and the same applies to the mountain lion. The regular route of the mountain lion is between one hundred and one hundred and fifty miles and personally I know of no place in the West where we could preserve these animals. I would like to see them live. If you can pick a place in the West where they will not do damage to man I would like to know where it is.

MR. CAREY: I should like to know just where Dr. Fisher gets his figures as to the increasing population of the United States. The population question is very complex, and there has been an article published recently in "American Mercury," written by two men who spend their lives settling population questions, which indicates that the trend of increase of population in the United States is falling off very rapidly and that in thirty years' time we will have a stationary population like that of France. Such questions are admittedly difficult but we must not be too sure that our population is increasing as rapidly as we have been wont to think in the past. That throws a little different light on the meat supply question, it seems to me.

Dr. Fisher has asked where in the West the mountain lion could be put. I should like to suggest that it would not only be safe, to put them in the Kaibab National Park, but it is perhaps the only thing that could create a situation which is somewhere near the old natural situation.

The men, the experts, who went to the Kaibab in 1924 reported that there were 30,000 deer in the Park, that they were dying of starvation, that the grass had gone, and that the foliage of many trees was eaten away as far up as the deer could reach. It seems to me that it would be eminently safe to put a few mountain lions in the Kaibab National Park, far away from ranches, and it would also be a good idea to get rid of some of the sheep.

DR. VORHIES: As a member of this Society from the state of Arizona I want to assure Dr. Fisher that we in Arizona feel that we have a hole where you can put mountain lions very safely. (Laughter.) That is the one which was so aptly described by the cowboy. You heard of the lady who was standing on the edge of the Grand Canyon. She had exhausted her adjectives and said, "I can't think of anything more." The cowboy stepped up and said, "Madam, you haven't said anything yet. It is a hell of a hole." (Laughter.) I should think that for the present we not only could put them there, but that we have them there, and that

we can well afford to keep them there and let them reduce that deer herd on the Kaibab.

I had the very great pleasure and privilege last summer of visiting the Kaibab for the first time after fifteen years in Arizona, and the scenes of destruction that I saw there will remain with me the rest of my life if I never go back again. I do not believe that by any process at present in sight we shall reduce that deer herd in the next twenty-five years to what it ought to be reduced to, to bring that forest back. We need the mountain lions. They are there and they are being let alone for that purpose.

MR. GOLDMAN: There are just three or four points that been have brought up that I would like to touch on. One is that as far as I know no one in the Bureau of Biological Survey is inhibited from saying what he thinks about the domination of the Bureau by the stock interests or anything of that sort. Dr. Adams implied that we are under some such sinister influence since the war. We admit right away that the stock interests, which represent millions of dollars, are intensely interested and see to it that we get some money to carry on this work, but this work was started in 1915 long before the war.

About extermination, I think that this book [The Biological Survey, Its History, Activity, and Organization] was written by a man who is perhaps a hack writer. I never saw the book until it was published so I had nothing to do with the information that went into it. We have men that come into our offices and talk to us, hack writers, and they go off and write stuff that we did not tell them at all. They get an idea from us and write something else. Some of those statements are apt to creep in and say more than they really mean.

It surely is not the policy of the Biological Survey to exterminate any species. We do exterminate them locally. I think that is absolutely necessary. At this stage of civilization we have to admit that the interests of humanity are paramount. We love these animals, a good many of them, but when they run counter to our interests they have to go. They have to go locally. They have gone in the East. If these animals should not be exterminated in the West why should not they be reintroduced all over the East?

I will agree with Dr. Vorhies that in Arizona in the Grand Canyon there is room for a few mountain lions and there may be room in other places. I do not quite agree with Dr Fisher there. I do not think we have to take the last animal everywhere, but on account of their habits, as Dr. Fisher has shown—they wander far and wide and mountain lions and wolves are so frightfully destructive of domestic stock and other interests—we surely cannot maintain many of them, particularly if they do start to wander. On the Kaibab it is true that the mountain lions were probably reduced too far in the past. That is one of the reasons the deer herd grew. But since the deer have increased there, they are eliminating the forage and now they are eliminating themselves, and for a number of years the mountain lions have not been interfered with. We have not had any man kill mountain lions on the Kaibab for years. How long is it?

DR. FISHER: About two years.

MR. GOLDMAN: I thought it was longer than that.

DR. ADAMS: That is mighty recent. It ought to have been stopped ten years ago. It would have saved you money.

MR. GOLDMAN: I would agree, under the peculiar conditions on the Kaibab, the mountain lion should not be interfered with there. I think they are one of the best controls we can have of the deer in a place like that where the deer are too abundant and where it is so exceedingly difficult to control their numbers. In an area like that when you get a breeding stock of deer it is mighty difficult to bring them under control.

Of course, there have been all shades of opinion and much misinformation quoted and written about the Kaibab. The fact is that there are not nearly as many deer now as there were in 1924. The deer reached their peak there in that year. Since then they have been reduced. But they are reducing the forage at a still faster rate, and of course we do not know just what the end will be. It seems to me that it will take a good many years probably before the situation is straightened out so that the vegetation can come back in any great quantity.

MR. HENDERSON: I should like to ask the last speaker a question. One of the preceding speakers said, I think, that he believed sheep should be eliminated from interfering with the Kaibab deer. I should like to have Major Goldman tell us to what extent domestic sheep are responsible for that condition among the deer.

MR. GOLDMAN: When the point came to the attention of the Forest Service in 1920, I think it was, that the deer were doing a good deal of damage to certain sections of the area, particularly in the winter, they began reducing the livestock. It was noticed that there was a general overgrazing of that area. Special efforts were made to reduce the livestock and they were progressively reduced until now the only livestock left on the entire Kaibab National Forest are something like 1500 head of cattle and about 2400 head of sheep. That is on an area of something like half a million acres on which formerly there were 15,000 head of cattle, and I do not know how many sheep, but a large number. The only part of the Kaibab where there are any sheep at all now is up on the north end where the deer do not go to any great extent. Does that answer your question?

MR. HENDERSON: Yes.

DR. BLAIR: Mr. President, before I moved up from the rear of the room I thought I heard Dr. Fisher predict that unless we exterminated the coyote we should all turn into Chinamen. (Laughter.) I just come up here to get that straightened out.

One of the chief objects of the New York Zoological Society is the preservation of America's wild animal life. That is of course the matter in which we are all interested, as mammalogists. It is unalterably opposed to the extermination of any single species, not because of sentiment, but on moral grounds, and it is also not interested in the introduction of foreign species to replace our native born ones.

Perhaps Dr. Fisher was right in not having the hippopotamus imported to eat up all our native grasses in the South, or the rhinoceros to eat many of our beauti-

ful desert plants. I am with him there. We recognize that it is necessary to control predatory animals in certain localities, and I was very much interested to learn that the Bureau of Biological Survey is seriously interested in making an investigation and perhaps will modify the word "extermination" in future reports.

MR. H. H. BAILEY: Mr. Chairman, to those who have read the newspapers in the last year it is evident that Florida is trying to secure a national park. The bill I think is in Congress at the present time. In this area that we propose making into a national park we have a puma that is somewhat similar to the western mountain lion, and I think we have in this area eight or ten specimens left, and I hope our mammalogists will not come down there and collect those before the national park goes through. (Laughter.)

But those of us interested in the wild life in that section in the last six months have given a great deal of consideration to the thought: Shall we have a national park, or shall we have a wild life preserve? If I thought that we were going to have our few remaining pumas exterminated in that area as a national park, I would be very much opposed to having it a national park. I would rather see it remain as it is, run over by some six or seven hundred Seminole Indians who are making a living, with no support from the Government, not abiding by the laws of Florida, with the help of a few renegade trappers, in the three lower counties of Florida of which the proposed national park will take in a large area.

It is a question in the minds of some of us whether we want a national park for that reason. I have not taken it up with the Bureau of Biological Survey yet as to how they stand. There has been a lot of newspaper talk, a lot written, and a lot of hot air lectures given by some people regarding this area. A great deal of it is not true. Some of it is true. But I believe if we can have either a national park or a wild life sanctuary there and keep our few remaining catamounts down there with the other wild life we have, and keep out some six or seven hundred Seminole Indians, that Dr. Fisher can come down there and visit me and I will be able to show him a place where he can safely keep catamounts and show them to tourists in the winter as well as in the summer.

WEDNESDAY AFTERNOON SESSION

May 21, 1930

VICE-PRESIDENT T. S. PALMER, presiding. Presentation of paper entitled:

PREDATORY MAMMAL DESTRUCTION

BY E. RAYMOND HALL

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A major one of the North American wild life problems is the destruction of fur-bearing mammals which accompanies the methods at present employed in the killing of coyotes, chiefly by workers of one division of the Bureau of Biological Survey of the United States Department of

Agriculture. The executive officers of the Bureau who favor a continuation and extension of this work, over the protests of practically all biologists, including, I have reason to believe, a majority of those within the Biological Survey itself, have contended that there is no significant evidence of destruction of fur-bearers. To meet this contention I would cite the following case which lately came under my personal observation.

One of the federal predatory animal catchers near whom I did vertebrate zoological field study in a valley some fifteen miles wide and seventy miles long in extreme eastern Nevada during May and June, 1929, took, by trapping, on an average, one reportable carnivore per day. Reportable Carnivora, according to him, were coyotes and bobcats which were killed for the assumed benefit of the sheep ranchers of the region. About one-fifth of this total number of sixty (and he averaged about 365 per year in the particular valley in which he worked) were bobcats and the remainder were coyotes. However, during these same two months he also took more than sixty badgers, five or six gray foxes, two golden eagles, and a "few" turkey vultures. This hunter, like others in the Great Basin region, despised the badgers in particular, because the badgers, he said, came to his sets more readily than did the coyotes, and the trapper believed that they prevented him from catching as many coyotes as he otherwise would take. This man took pride in his record which was published monthly and distributed to the Biological Survey predatory animal catchers in the state. As a result, he worked industriously in an effort to stand well toward the top of the list of some thirty-odd hunters. The fact that his work was disapproved of by the majority of the inhabitants of the valley, because it depleted the fur supply, did not deter him in his efforts. He said that he seldom reported taking anything but coyotes, cats and lions, since the others didn't count in his favor. "Although some trappers report badgers and other things, I generally don't 'cause it's too much bother and they don't count much in a fellow's record" were his words. This man confined his activities to the floor of the desert valley where he could, by auto, visit each of his approximately 300 traps at least once a week. He made his headquarters at the various sheep ranches in the valley, although during the particular time of year I was there the sheep were in the two mountain ranges on either side of the valley. The sheep men to whom I talked about this particular work were cordial, but at the same time said they relied on their herders with the sheep to kill any coyotes which might get the lamb- or sheep-killing *habit*. They recognized the fact that

this hunter could not work in the rough mountains near the sheep, for, as the hunter himself said, "By working on the valley floor I can get over more territory and make a better record." Also, this trapper had the wisdom to point out that "by trapping just in the valley there will always be plenty left to catch of those that come down from the mountains to feed on the ground squirrels."

On the actual ground in this particular valley where the coyotes and badgers were being killed as they came to prey on the ground squirrels so abundant there, six or seven dry farmers were scheduled to start homes within the year. Now the damage these uncontrolled ground squirrels and rodents would do to their crops can only be estimated, but it would be large and the federal funds spent in killing the ground squirrels would be no small amount. As it was, the ground squirrels, which were so abundant, in part because their natural enemies were reduced in number, had done great actual damage to the forage on much of the best grazing land in the valley.

As regards poisoning in the winter, this trapper had much to tell us. For one thing the badgers were a "nuisance" then, too. "They come as far as they can smell a bait" were his words. He stated that kit foxes, also valuable furbearers and rodent destroyers, were not much of a problem since there were not many to begin with in his particular region, and he thought that he had poisoned all there were in the valley during his first winter's work, when he took several. In this region skunks were rare, and those he took were found mostly in the vicinity of poison stations made in winter.

This man destroyed a tremendous amount of valuable fur. I am reliably informed that badgers from that particular region early last winter averaged around $18 per skin. In that case I figure that he threw away about $1080 worth of potential badger fur in the two months that I was there. In winter when the furs were marketable he saved as many of the pelts as he could. His operations then were carried on mainly by poison, and he thought that he did not find more than one-third of the animals poisoned, at least until the following spring.

On this basis, in this valley which produces good fur by reason of its cold winter climate, possibly $6,000 worth of badger fur; $2,300 worth of coyote fur; $200 worth of bobcat fur; and $150 worth of gray fox fur, were taken in a year. If one-third of the fur taken in the winter (November 16 to March 16) was saved, as the trapper believed, we still have fur destroyed to the value of about $7,700. Counting the $1800 received in salary, the overhead, cost of poison furnished, and fur value

of the kit foxes and skunks destroyed, the figure is around $10,000. To offset this debit it is necessary to assume that the work saved around 1,000 sheep valued at $10 per head, which the sheep men and the predatory animal men tell me is a fair price. My investigation, the testimony of the sheep men and the testimony of the predatory animal hunter each indicated that it was very unlikely that this work saved anywhere near 1,000 sheep per year.

We have here in a desert region untempered destruction of a valuable fur-bearing animal, namely the badger, where, up until the past year when the price of badger fur leaped to unheard-of prices, the Biological Survey has argued that no valuable fur-bearing animals except coyotes and bobcats were taken. This is entirely aside from the great value which the badger has as a destroyer of rodents and even insects injurious to crops and to forage on range lands.

It seems clear that in this case, as in others we know about, on the score of fur value alone a heavy loss to the general public resulted. If the value of the six species of fur-bearers as destroyers of rodents injurious to agriculture be added, the loss becomes tremendous.

The claim is made by men in charge of this animal destruction that the case just cited is merely a bad spot such as is likely to occur in any large organization.

As concrete evidence to the contrary may I mention, without at this time elaborating the details, a second case which came to my attention: A poison campaign conducted in the San Joaquin Valley where actual counts of dead animals indicated that more skunks, kit foxes and fur-bearers than coyotes were destroyed.

A third case, in western California, where I personally made counts of dead animals taken by a federal killer, indicated that the striped skunk, California's most valuable fur-bearing mammal, was destroyed in far larger numbers than bobcats and coyotes combined. Although this was in winter only the coyotes had been skinned.

A fourth case in the same general region had an even worse aspect with respect to destruction of fur-bearers. You recall that in California, not a good fur state in many respects, the return to trappers on the catch of wild fur-bearers amounts to over a half million dollars a year.

A fifth case of last winter, involving my own backyard, had to do with the persistent efforts of a federal predatory animal killer to operate on a cattle range where he was not wanted by the cattle men. When run off the land of the ranchers the hunter went along the roads and slipped traps under the fence, for, as he is reported to have said when caught at

this, "I have to have some place to work." The cattle men realized that the large California ground squirrel, so numerous there, was seriously damaging the range. They wanted the coyote to breed up again so it could act as a check on the ground squirrels. This increase of ground squirrels was in spite of attempted federal and state rodent control work. The carnivores had been trapped and poisoned here previously by federal killers. Other people in the country wanted the coyotes, and especially the smaller carnivores, left to serve as checks on the ground squirrels because the squirrels here were, and still are, infected with bubonic plague. A very large number of people, ignorant of the above-mentioned considerations, wanted the carnivores left on account of their fur value in winter. When I mentioned this case to the predatory animal control official in charge of the work in that state he remarked that I overlooked the fact that they had had almost no complaints from sheep men there about coyote damage, which showed the effectiveness of their predatory animal killing. I then was able to enlighten him to the effect that all the sheep had been removed from this particular region three years before, a fact unknown to him!

In still an additional case I saw a petition signed by ninety residents of a given region asking that the destruction there of fur-bearers by a federal killer be stopped. The official in charge of the killing said: "We can't pay any attention to that because these three men [indicating letters from three sheep owners of the same region] pay more taxes than all those ninety put together." No attention was paid to it, either.

The numerous letters on file in California institutions having to do with the study of wild life set forth scores of additional cases.

The fact that the work of every killer of the Bureau of Biological Survey with whose activities I am familiar, is similar, and the fact that other naturalists (whom I can cite) know of similar cases, strongly indicates that these are not mere isolated cases but that they are rather general, or, to put it very mildly, at least much more common than the particular Biological Survey officials who are in direct charge of this work allow.

It is maintained also by the executive officials that their trappers do report all (I think they must mean nearly all) fur-bearing mammals killed. In the case just cited, of destruction of badgers in Nevada, only nine badgers were reported. Seven of these were purposely taken and reported for a legitimate scientific use and are not included in the sixty odd taken in the two months. Here then, two badgers out of about sixty were reported. I am informed that the last annual report for the whole of Colorado shows only one skunk taken there last year by the federal

trappers and poisoners. Of course it is ridiculous to maintain that this number is correct. If a federal killer does report the numerous fur-bearers taken, one of two things happens—if anything at all is done. The trapper may be discharged—and I have never known one to be discharged for this—or he is asked not to take so many fur-bearers. Now what will the trapper, or any other who hears about the matter, do thereafter? Of course he does just what every Survey killer with whom I have talked says he does, namely "not report most of the other things [fur bearers] 'cause it don't pay." One varied this a bit by saying with a grin "I just don't see 'em".

In using poisoned baits a relatively larger number of coyotes than of other carnivores generally will be found even by a person who *wants* to find them all. For one thing the coyote is so much bigger than the others that he is more easily seen. Secondly the coyotes in winter generally do not live in burrows as do the fur bearers. Thus, when sick or dying from poisoned baits many of the fur bearers disappear in their burrows, whereas the coyotes more often die in the open. Naturally, therefore, a larger proportion of coyotes than fur bearers are found in most cases. Even so, thirty-two skunks and kit foxes were found above ground in one place where poison was put out under a Biological Survey killer's direction, as against eight coyotes; just four times as many other carnivores as coyotes, not allowing for the fur bearers which escaped into their burrows to die. Subsequent investigation in the area where this occurred indicates that if another poison campaign were conducted there it would take only about an equal number of coyotes on the one hand, and valuable fur bearers also beneficient to agriculture on the other; because of course, as in so many other parts of the west, the fur bearers were so thoroughly killed off during the *first* or *initial* campaign.

By reason of so many trappers not reporting all fur bearers which they take, other than coyotes and bobcats, their field foremen and state leaders and other men in charge, naturally are not so well informed as could be wished. Some, however, admit, for the sake of argument, that granting this economic loss to the general public, no other course of action is possible in view of the pressure which, they say, the sheep men are so well organized as to exert.

All in all, I am strongly of the opinion that such activities as these are many times over more of a loss to the country than they are a gain. Impartial biologists in general seem to have this opinion. They and others think it imperative that the predatory animal killing as carried on under present methods be greatly reduced, with elimination of all poison

work, until the long hoped for laboratory studies by trained stomach-analysts and field studies by competent, impartial, vertebrate biologists shall have been made to determine where killing is required and in what amounts. This will allow retention of a trained force of men which will be available for work in connection with a serious outbreak of rabies, to hunt down actual killers among coyotes, wolves or bobcats, or to meet other needs for rational, intelligent, economically justified control. That the work instead should be so much increased as is provided for in the new ten-year program (see Bill No. S. 3483, now before Congress) is almost tragic in its probable effects, economic as well as otherwise.

I recognize that control is necessary, for many coyotes will kill sheep, especially at lambing time, although as many sheep men have admitted to me, it is only one coyote out of a great number that develops the *sheep-killing habit.* A vital point in connection with this control is that the present high price of furs provides a sufficient number of trappers in many, if not in most, regions to adequately keep down the numbers of coyotes and bobcats.

That the requests of biologists for statement of an actual policy of administration of our wild life resources have been ignored, alone seems just cause for the current dissatisfaction. The nearest approach to a statement of a policy was made three weeks ago at the hearing on Bill H.R. 9599 before the Committee on Agriculture, House of Representatives. There the Chief of the Bureau finally said (although changed in the hearings as published) after repeated sharp requests to state a policy: "Well, all I can say is we have these requests [of sheep men for killing carnivores] and we want the money to do the work." Any biologist knows that the Biological Survey should operate *not on requests* for killing *but on needs* for it. It is worth noting that the United States Forest Service has had similar problems. Indeed, the sheep men went so far recently as to attempt to take the management of grazing away from the Forest Service, in part because the Service would not yield entirely to their demands, but instead took into consideration the welfare of game, the retention of ground cover to prevent a too rapid run-off of water, etc. In other words, the Forest Service did take issue with, and indeed won their case against, the very interests of which several Biological Survey executives say that their Bureau cannot afford to do otherwise than meet every demand, else their appropriations will not be forthcoming.

It goes without saying that the Bureau of Biological Survey cannot long continue on such an insecure footing with lack of policy. It will

have to reorganize so as to give due regard not only to the sheep industry, but also to our valuable national resource, the wild fur supply; to the needs of the farmer for natural control by predators of rodents and insects injurious to agriculture, and to other interests. Our hope is that this reorganization will be brought about before additional destruction of our national resources is carried so far that recovery is made impossible.

At times, certain groups will of course insist that their interests receive attention to the exclusion of, and at the expense of, all others. However, if the United States Bureau of Biological Survey is to operate on federal funds from the general tax levy, it sooner or later must develop, state, and carry out a policy of administration of our wild life resources accomplishing their utilization for the greatest good to the greatest number of people, not to minority interests.

VICE-PRESIDENT PALMER: Discussion is in order.

MR. HENDERSON: Mr. Chairman, the paper just presented would be more helpful to the Biological Survey if it were supplemented by a statement giving the names of these individuals who gave the information to the speaker. The first one referred to I know was in Nevada and unfortunately is a man who died a year or so ago. We can not very well do anything about that case now.

The only comment I have to make in regard to that is this: That the writer of the paper was in very close and friendly relations with the director of our work in that state at that time, and was offered the facilities of his office, and was in constant contact with him. It seems to me that in the interests of conservation and friendly coöperation the incident might have been brought to our attention at that time, and steps could have been taken to correct the situation, if something was going on without the knowledge of our leaders and the information was in possession of Dr. Hall. Nothing of that kind, however, was done. The first we heard of it so far as I know was this spring, nearly two years later. Now the man is dead and we do not know anything about it.

This trapper did report taking badgers to Mr. Sans, who was in charge of the work in that state, and said he made a deliberate attempt to catch badgers because Dr. Hall desired some for scientific purposes. In addition to these he reported capturing a few others. I think Dr. Hall said some time ago that he knew of his own knowledge that he took sixty. Maybe he did. I do not know. But he did not report them. But if he did take them, and was remiss in his duties, there was a wonderful opportunity to bring the matter to our attention and help us straighten this thing out. Not to do so was, it seems to me, an indication that at the time it seemed to Dr. Hall more desirable that this man be continued on the payroll, after he had shown that he was an unfit person by doing those things, than it was to take steps and save the wild animals that he was destroying.

With regard to the other cases we have no knowledge whatever as to where they took place so far as I know.

DR. HALL: That will be forthcoming in the next paper. I think you will get that shortly.

MR. HENDERSON: We will be glad to get that. If there are any matters brought to our attention that need correcting we will correct them. Our men in the field each have one state as a rule. Each man spends a great deal of time in the field. However, those states are large and quite likely things occur, when they are not on the ground, of which they do not learn. Our leaders do exercise as close supervision as possible. They discharge hunters and trappers in many cases. The turnover in the past fourteen years has been very great. Some of them are quite independent in their ideas, and resign. A great many have been discharged. If we had known who these men were to whom Dr. Hall refers we would have been glad to do anything we could to straighten out a situation here and there which needed attention.

I do not believe, however, that these men, many of whom have been with us a good while, are neglecting their duties or are deceiving the Bureau, although it may be done to a limited extent.

I do not think Dr. Hall gave quite a fair report on what happened before the Committee on Agriculture. I was there. The Chief of the Bureau, as has been stated, was being harassed by a multiplicity of questions from all sides of the table. I have been before Committees when it seemed as if everybody on the Committee asked me the same question at the same time, without giving me a chance to reply. They were all interested and they all wanted to get replies to certain questions that occurred to them, and this one asked that question and that one asked another question, and I could see that the Chief of the Bureau was greatly worried and embarrassed by this questioning which was being directed at him and by the frequent interruptions. He may have said something like what has been reported without being permitted to finish his statement.

DR. HALL: May have? Did he not say that?

MR. HENDERSON: I do not remember the exact words. What I mean to say is this: At the time that he answered those questions he was considerably embarrassed by this general cross-examination that was going on. I would not attach as much importance to what a man said under those circumstances as I would to a prepared statement which he might give on a subject.

The facts about the ten-year program are these: Some two or three years ago when Mr. Redington and I were both before the Subcommittee on Appropriations for the Department of Agriculture, Mr. Buchanan of Texas, I think it was, suggested to the committee that the Biological Survey should be called upon to submit a five-year or a ten-year plan for the control of predatory animals. Mr. Buchanan stated that in his judgment the work had not been carried on on a sufficiently wide scale and that it should be extended in Texas. We told him that we had no funds to extend it. The result was a resolution passed by the Congress asking the Secretary of Agriculture to submit to Congress a ten-year program or a five-year program on the control of predatory animals.

After receiving reports from all of our men in the field and consulting together in Washington this program in response to an act of Congress was submitted, and

that is what the ten-year program is. It has been published. There is nothing about it that is secret. It is all right there in print. I have a copy with me and other copies can be obtained.

It was a consideration of that ten-year program that was before the Committee on Agriculture the other day at the time to which Dr. Hall has made reference. Bills have recently been introduced in Congress, one in the House by Mr. Scott Leavitt of Montana, one in the Senate by Mr. Peter Norbeck of South Dakota, to provide for an authorization for the increase necessary to put the program into effect. I believe that the bill has not been reported out by the Committee on Agriculture in the House since that hearing.

The Biological Survey from Mr. Redington down is not unwilling to coöperate in improving any methods that we have that should be improved upon. We are glad to have the advice of people who have information which they can give us, or helpful advice, but we do feel that we are entitled to fair play, that we should receive the coöperation of the people of the country who are interested and who have the information that we want. The best way to get results is not to fight us but to work with us. I do not believe that the Chief of the Bureau deserves to be attacked. I think that he should have the coöperation of the people.

I remember, that during the past year several people said that they were going to study our methods of predatory animal control. One or two made some such studies in the field. To what extent I do not know. I do not know that they consulted with the men in the field. I am quite sure that they did not report anything to the Biological Survey, to the Chief of the Survey, I mean. Letters have been written both to the Department and to the Chief of the Bureau saying that they were to be attacked but when facts were asked for they were not given us. And we do not know what those facts are, except as they come to light from time to time like this.

We will be glad to get the facts however they come, but why not all get together and coöperate and not quarrel about it? We do not want to quarrel with you people. There is no group of men that I admire and like personally any better than those in this organization. Certainly I do not want to quarrel with any of them. I know Mr. Redington does not. We would like to have your assistance and coöperation. We do not feel that we have had it in some respects in the last few weeks.

DR. HALL: I think that honest differences of opinion are no ground for other feelings. And may I say that perhaps we have the wrong impression about these cases, but you remember that Dixon wrote in about them. In other words, this is the fourth or fifth time that we have come to you with bad cases and nothing was done. So this seemed to be the next logical step. I do not want the impression to get abroad that we have not gone to you first with the other cases, as we have. You received other letters and we have carbons of those letters to prove that. So this is not like going in from behind. Personally, I would like to coöperate.

DR. ADAMS: Mr. Chairman, I would like to congratulate Dr. Hall on bringing these concrete cases before the American Society of Mammalogists. I think

every man who has been out in the West and talked with the men right on the ground has had many different examples comparable to this sort of thing.

We have been hearing such reports for years and for Mr. Henderson to come to this meeting and talk as if we have not tried to coöperate makes the words of the English language mean nothing at all, because for five years this Society has tried to coöperate with the Survey. And we get that kind of talk right along. It is time there was a different attitude. This organization has been trying to coöperate. Then they say to Dr. Hall, "Why didn't you tell us about these things before?" [To Mr. Henderson] It is your responsibility and business to know what your organization is doing.

MR. GOLDMAN: I should like to ask Dr. Hall one or two questions. Did you see those sixty badgers that were caught?

DR. HALL: I saw the majority of them.

MR. GOLDMAN: How many did you see?

DR. HALL: I could tell if I had my notebook here. I went out on various days and each day the trapper went in his car he caught more badgers than other things.

MR. GOLDMAN: Was he catching them for you?

DR. HALL: Not at that time. The nine badgers he got for me were taken after this experience.

MR. GOLDMAN: I have had a good deal of experience with badgers in my thirty-eight years of association with wild life and a drove of sixty badgers seems to me to be quite a large number. My experience with these animals leads me to believe that they are usually pretty solitary and they do not range together very much. A badger apparently has his territory, and the general idea you get of their workings in the field and from what you see of them is that they would probably fight another badger out, and I cannot conceive a man getting sixty badgers in a very limited territory.

Another point on the value of the furs: I have before me the winter sales of the New York Auction Company, one of the large fur companies of the country, and they divide the furs into three classes, Northern, Western, and Southwestern, and I have the figures from 1928 to 1930. In 1930, the last sales, the values of badger furs from the Western district ran from $1.20 to $14.75, and from the Southwestern district, 4 cents to $7. I am not quite sure which district they would put animals from Nevada in but they do not show very high values. But if these values are lying around there in furs, why does anyone bother raising sheep? It seems to me that this man working for us would have been a good deal more profitably engaged if he had been trapping a few furs.

DR. HALL: He intimated he might have done that.

VICE-PRESIDENT T. S. PALMER, presiding. Presentation of paper entitled:

FUR-BEARERS CAUGHT IN TRAPS SET FOR PREDATORY ANIMALS

BY JOSEPH S. DIXON

University of California, Berkeley, California

(Read by Mr. A. B. Howell)

Confirming previous reports, Mr. J. Elton Green and Mr. Harold Gilmore stated to me that on December 22, 1925, they had found, in Wild Cat Canyon, Contra Costa County, California, a badger and seven skunks which had been caught in traps set by a predatory animal trapper. Mr. Gilmore and Mr. Green had talked with this particular trapper when he was setting out his trap line, and he had positively stated that he was a regular federal predatory animal trapper operating under the direction of the Biological Survey. Investigation showed that these fur-bearing animals had been caught in steel traps and had been shot or knocked in the head, and then thrown out and left to rot, unskinned.

In order to verify personally the fact that fur animals had thus been trapped and left unskinned, the next day I went with Mr. Green and Mr. Gilmore to Wild Cat Canyon where I found conditions exactly as they had been described. The Survey trapper had operated there from about November 30 to December 20, and had said that only traps and no poison had been used. He reported that he had trapped fifteen wildcats and about an equal number of coyotes. Going over a portion of the trap line, we found the carcasses of the following animals: Striped Skunk, 4 (unskinned); Spotted Skunk, 1 (unskinned); Badger, 1 (unskinned); Coyote, 3 (skinned). The five skunks were found along a three mile segment of trap line. We cannot say that we found all of the fur-bearers that had been trapped, since many of those found had been thrown into dense thickets while the coyote carcasses and the badger had been left out in the open, unconcealed.

Three dead skunks, with trap-mashed legs and mashed heads, had been thrown, unskinned, into a nearby ditch where we found them within ten feet of each other. One of these skunks was large and the pelt was, for this locality, prime and good, yet the pelt was not saved. The other skunk lay rotting in a stream of water which drained directly into our city water supply. This all occurred on lands of the East Bay Water

Company where, because of the danger of pollution of the water supply, the land was posted and riders hired to keep people off.

The badger had been caught, killed and left right where it had been trapped. The pelts of the skunks and badger were too much decayed to permit of their preservation as specimens. The skulls of the badger and of the skunk were saved and filed, with the photographs, in the Musuem of Vertebrate Zoology, where they were shown and called to the personal attention of Dr. Nelson, then Chief of the Biological Survey.

Personal inquiry of the State Leader of predatory animal control brought out the fact that this Survey trapper had reported the wildcats and coyotes he had trapped, but that no mention of the skunks and badger had been made in his official report. I have been told by several Survey trappers that it was not wise to report the capture of the smaller fur-bearers, such as skunks, which get into the traps set for coyotes. If pelts of such animals are worth only a dollar or so, the Survey trappers claim that it is a loss of valuable time to skin them; and that if they are not skinned they never appear on the official records, which is also to the trappers' advantage. Everyone who has trapped or poisoned coyotes in a region where skunks, gray foxes and badgers are numerous, knows that some of the skunks, foxes and badgers will be caught in the coyote traps or killed by the poison, when it is used.

In late January, 1930, when I discussed this point with one of the more successful Survey trappers in California, he pointed out that on a certain 3000-acre tract of foothill land in the Sacramento Valley that had been thoroughly poisoned for coyotes the year previous, skunks, coons and foxes had thereby been killed off, by taking the poisoned bait; so that there were practically none left the following year, and consequently the poisoning of the surviving coyotes and those which re-invaded this important sheep-raising area was much simplified. On the other hand, he called attention to an adjoining tract of 7000 acres upon which no poison had been used, and where, as a result, skunks, gray foxes and coons were still numerous. The skunks were especially prone to get caught in the coyote traps, and this trapper wisely refrained from setting his traps where skunks dens or droppings indicated that these animals were numerous.

Careful investigation of this problem, extending in California over a period of fifteen years, has convinced me of the following:

1. That with any known system of trapping coyotes in California, where fur-bearers are plentiful, some of the latter are bound to be trapped along with the coyotes.

2. That the actual destruction of such fur-bearers is less where traps, rather than poison, are used.

3. That the official reports of the Biological Survey do not reflect the true number of fur-bearing mammals thus destroyed.

4. That the loss of such fur-bearers can be reduced and kept at a minimum through more careful attention to the placing of traps and through a more restricted and a more careful use of poison in such work.

MR. HOWELL: It has been claimed by officials in charge of predatory animal control that at no time has other than hearsay evidence been submitted relative to the destruction of fur-bearing mammals through their being caught in steel traps or killed by eating poisoned baits set out to destroy predatory animals.

I herewith present to you, in behalf of Joseph Dixon, of the University of California's Museum of Vertebrate Zoology, extracts from a letter which Mr. Dixon wrote to Mr. Redington last February.

COPY

Mr. Paul G. Redington, Chief,
Bureau of Biological Survey,
U. S. Department of Agriculture,
Washington, D. C.

Dear Mr. Redington:

In reply to your letter of February 10, I want to reassure you again that I am not against the control of predatory animals, as a general principle, because I realize that, from a practical standpoint, such things are absolutely necessary. You are doubtless aware that from time to time, both in published statements and in letters, I have taken the stand that the Biological Survey is the best agency to carry on such work under normal conditions. On the other hand, in going about in the field, I find that there is frequently quite a wide discrepancy between what the Chief and other officials of the Survey outline as being the methods under which the Survey's predatory animal men operate and the way in which the work is actually conducted in the field. In other words, there is quite a discrepancy at times between principles and practices. It is this feature of the work to which I have called attention, not simply to find fault with the Survey but rather to try to give constructive criticisms which will result, I hope, in the Survey being able to give improved service.

With reference to food of bobcats, I would like to inquire who examined the stomachs, and what qualifications or training said individuals may have had in stomach examinations.

Referring to the statement of Mr. Ruddimeyer, a rancher near Laytonville, Mendocino County, California, that in August and September, 1919, he had lost 175 chickens and 40 pigs through depredations of bobcats, I would like to apply the same yardstick that you want to apply—that is, what concrete evidence can you or he produce that said destruction was caused entirely by bobcats? The reason that I ask is that I have made investigations of a number of such cases in

California, and in many cases I have found that the loss of chickens, especially, was due to two-legged (human) thieves, rather than to four-legged thieves.

Regarding the food of wildcats in California, as you know, I have recently made an extensive study of this problem and have taken the pains, in every case, to ascertain what bait was used in catching the animals. As you doubtless know, in the case of bobcats the majority of them are caught in baited traps; and I have found, on investigation, that the trappers, including the Survey trappers, frequently use the fresh feathers and remains of game birds, or the fur and remains of rabbits, as bait at the trap. Unless this question of bait is taken into consideration, a great injustice is liable to be done to the bobcat, because it is obviously unfair to bait a trap with the head, feet, and entrails of a cottontail rabbit to catch a hungry bobcat, with an empty stomach, which might come along, and then to report the stomach contents (bait) as "Game: 100%." To my knowledge, this has been done in many instances where the trapper in the field has examined the stomach contents. In other cases, old horses have been killed by Survey trappers and utilized as a free lunch counter for coyotes. Then, after the coyotes got into the habit of going to the carcass in large numbers, poisoned baits were slipped into the carcass or deposited nearby, and a large kill of coyotes resulted. Naturally, when the trapper examined the stomachs of said coyotes, he found "Domestic stock: 100%." This did not mean that the coyotes killed the horse, because the horse had been killed on purpose by the Survey trapper to serve as a lure for coyotes.

I want to reassure you that I have had no criticism or fault to find with stomach examinations made by your trained men in Washington, such as Mr. Sperry, because they realize the difficulties involved and their findings are generally accepted as being fair and not biased. However, this obviously does not apply to examinations made in the field by your predatory animal control men, many of whom (as Dr. Nelson has definitely stated in a letter) are not sufficiently trained to make a dependable report on stomach examinations.

To sum up the whole question of bobcats in California, there is no doubt but that the animal is decidedly harmful in certain localities at certain times, such as the lambing grounds in the spring. No one, so far as I know, who is familiar with conditions, objects to control of the bobcats in such localities under the above conditions. What I do object to is the widespread efforts of the Survey trappers in an endeavor to make a showing by killing bobcats where there is no real need of their control.

In general, I have found, through examinations of 186 stomachs of bobcats, in 62 localities in California, made by 45 men (whom I have found to be intelligent and reliable), and through examinations of 71 stomachs, from 18 localities in California, made by me in the laboratory, that the food of the bobcat in California (throughout the state), is, from man's standpoint, 50% beneficial, 33% harmful, and 17% neutral. These examinations are recorded and I can produce the evidence in every case in which I have made an examination. I feel, therefore, that greater care should be exercised, for the benefit of the Survey itself, in keeping control of predatory animals restricted to the localities where it is most needed.

Yours truly,
(Signed) JOSEPH DIXON.

VICE-PRESIDENT PALMER: Discussion is in order.

MR. GOLDMAN: I have not very much to say, only on the point that Mr. Dixon mentions about the taking of small furbearing animals in California.

The conditions west of the crest of the Sierra Nevadas are widely different from the conditions east of that crest. Any place west of the top of the Sierras the skunks and foxes and small fur bearers are exceedingly abundant but east of that crest they are very, very much rarer, and I think that Dixon is right when he practically says that no campaign should be carried on against coyotes where many fur bearers are attracted. I do not know of any other part of the country where we would be likely to get so many.

CHAIRMAN PALMER: Are there other comments?

DR. FISHER: May I ask how many of the trappers he questioned?

MR. HOWELL: I do not know. I have no idea.

DR. FISH[illegible]: I understand Dr. Hall talked to two so that his evidence, out of six hundred trappers, would be less than one-fifth of one per cent.

VICE-PRESIDENT T. S. PALMER, presiding. Presentation of paper entitled:

AT THE CROSS-ROADS

BY A. BRAZIER HOWELL

Johns Hopkins University, Baltimore, Maryland

As many of you know, I became interested in the predatory mammal problem last year, and, with the backing of Mr. Madison Grant and the New York Zoölogical Society, I undertook to make some investigations. This could not be exhaustive, by any means, for I had not the time to devote to such a project, but I wished to satisfy myself of the situation that must be faced.

The results, which I present to you today briefly and in as fair-minded a manner as I am able to do, are, to me, extremely significant as indicating the present day trend in wild life matters. No longer is the game hog the chief threat to our fauna, but rather the pseudo-conservationist who agitates for the protection of one or two game species and the eradication of everything else, and vested interests of one sort and another, working through legislative channels and by political pressure for systematized destruction.

For several years there has been expressed by members of this Society, in mild and rather guarded terms, dissatisfaction with certain policies

of the Biological Survey. We have all been loath to criticize the Survey openly for it is the veritable shrine of American mammalogy. For a great many years our attitude was, I think, that the Survey was the competent federal guardian of our wild life. If it did a thing or said a thing, that thing was right, for it was the expression of some of our most brilliant naturalists. That spirit, and that for which it stood, *was* the Biological Survey, a heritage of good will slowly erected throughout long years by the integrity of its policies.

Understand me clearly. In what I hereafter say there is no shadow of criticism of Biological Survey biologists. They are, without exception, the salt of the earth. To question the sincerity of their motives would be like stating that the sun rises in the west, and if Survey policies were left for them to determine we would have no cause for complaint.

Unfortunately, however, when we speak today of the Biological Survey we no longer refer to this group of biologists but to the men who are responsible for present day policies. Beginning in 1916, when the present predatory mammal control first started, there has been a steady and increasing appointment to the higher Survey offices of non-biologists, until today only a single one of the major positions is held by a mammalogist or ornithologist of recognized standing in these sciences.

Every one of us concedes, I am sure, that these executives are eminently able men, thoroughly conscientious according to their lights, and I have not the slightest criticism to offer of them personally, but only collectively. We care not in the least who runs the Survey so long as it is run on sound biological principles.

It is clearly evident that to these men our suggestions, based on biological reasoning, are nuisances if not downright impertinences. One of them has told me he considered that there always would be sporadic complaints from sentimental quarters and from cranks about predatory mammal work, and it was just a disagreeable part of the job to bear with these. I do not blame him particularly. But it is all too apparent, from many instances, that objection by biologists is regarded exactly the same as other obstructions, to be gently sidetracked by tactful, soothing utterances, and to be quickly forgotten. I know of many letters lately written to the Survey in this vein by prominent naturalists and always the attitude in reply has been that the item for complaint was an isolated instance, that the matter would receive attention, or similar vague statements to quiet the correspondent. Or if the letter were of a more vigorous sort, there has been apparent a resentment at the interference and a clear implication that the writer was an unreasonable

radical and an obstructionist. Even yet, after my letters and the printed protest signed by so many of you, the cry is uttered that I am a sorehead, my motives activated by venom because I am unable to get a high position in the Survey, that people will sign any protest put before them, that I know little about the matter, and that few of the protest signers have even seen a coyote.

What the Biological Survey seems not to grasp is that we have at heart the welfare of our wild life; that because the Biological Survey is the agency involved we have been most patient in waiting 14 years for proof that predatory animal destruction was justified and accomplished in a wise manner; and that almost without exception there is great dissatisfaction among us over present practices.

All of us, I believe, fully concede that some control of predatory mammals is necessary. Whatever may be our aesthetic feelings toward mountain lions and wolves we must admit that they are destructive and should be kept in check. Coyotes, too, do considerable damage in certain areas and should be thinned in regions where there are many sheep. But this should be done with discrimination and moderation, with careful consideration by a trained mammalogist of the local factors involved in each area, and not in the wholesale manner now attempted. Few of you realize, I think, the extent to which wholesale destruction is now carried. For instance, according to Biological Survey figures there were 140 predatory animal hunters operating last year in Wyoming alone.

But we have no objection to reasonable control. Whatever in our own minds we would like to see obtaining in wild life conditions we admit that concessions must be made by pure conservation to the economic exigencies of present day civilization, but we hardly feel that we should be the *only* ones to make concessions. As the most practical viewpoint I therefore base my arguments on economic considerations, and leave the aesthetic side, of equal or even greater interest to me, to others.

Accordingly I pass over the plight of the mountain lion and the wolf. You already know it. But I may mention that among the tens of thousands of carnivores killed in 1928 by federal hunters there were only 11 gray wolves. The rest have gone from the far west. In 1926 the Biological Survey said that there were no wolves known to occur in Arizona, and a few years ago that no more than 5 adult wolves were known to occur in Wyoming.

According to the reports of the chiefs of the Biological Survey there have been killed and recovered by federal hunters, since 1916, about

416,000 predatory mammals, with an additional estimated kill of 696,000 coyotes poisoned but not found, at a total cost of nearly 10 million dollars. This averages about $23 per recovered animal. Similarly, picking at random from the mimeographed report of Laythe, leader of predatory animal control in the Colorado district, I find that the cost for killing the 229 reportable animals destroyed was $23.21 each in October, 1929. This was computed by allowing $200 per month for Laythe's salary, which I understand is below the actual figure, $150 per month for three assistants (there are now four), a stenographer, and $4 per day for his hunters. A report in 1922 by Miles Cannon, Commissioner of the Idaho Department of Agriculture, showed that properly amended figures placed the cost of predatory animal control by the Biological Survey in that state at at least $15 per animal, and that at this time state bounties were paid on 72,182 mammals at a cost of $2.74 each. I cannot go into details here of the comparative desirability of Biological Survey results *versus* the bounty system, but many of us question whether the cost of control in many areas is not considerably more than the damage which predators may inflict.

I do not pose as an authority on coyotes. During field work in eight western states and in Mexico I have trapped some and shot a few more. But I have watched them hunting rodents a great many times and for 20 years I have owned ranch property in California where coyotes are numerous. In spite of the fowl occasionally missed I place a high value on coyote services, and there are many, many others who feel the same way. In fact many ranchers will not allow a federal hunter on their lands, so the traps must be set, or poison scattered, along highway fences. I know of many instances such as the following one recounted to me by Dr. H. C. Bryant. Several years ago the owners of Santa Margarita Ranch, one of the largest cattle holdings in southern California, waged a systematic campaign to eliminate coyotes. Subsequently the rodents increased to such an extent and so damaged the range that now they will not allow a coyote to be molested.

Where sheep are allowed to wander improperly herded or in areas where coyotes are unusually abundant and bold, damage to sheep may at times be severe, and horrible instances of slaughter may be cited, just as I can amass equally horrible examples of sheep slaughter by dogs. Also coyotes are very destructive to nesting ducks about prairie lakes, and we all wish they could be kept from invading new territory, such as Alaska and the Mackenzie region, where wild life is not used to coping with them.

Coyote damage has been much overestimated in many instances. Sheep men have told me that when a sheep was killed all that was necessary to get a hunter to clean out the coyotes in a region was to yell loud enough that they were being ruined. Not only are the sheep men powerful enough politically to get such service, but they can get almost anything else they want, and they want a lot. Great stretches of western country have been practically ruined by overgrazing, and several years ago the sheep men even tried to have all deer and elk in Utah killed so there would be more grass for live stock. I was assured by a senator not three weeks ago that the grazing interests could count on sufficient votes to pass almost any bill they wished.

Each coyote may do $50 worth of damage a year as claimed by the Survey. I cannot prove the contrary, but many of us doubt it. Dixon says this is not the case in California. It is human nature to exaggerate a personal loss and to the distinct advantage of the hunters not to look too closely into the details nor to discredit over estimates. I do not know winter conditions over the northern plains where coyotes may be made bold by hunger, but over parts of the west with which I am familiar, including Arizona, I do know that it is extremely rare for a coyote to kill even a healthy calf. They will, however, unhesitatingly pull down a sick steer, which is an excellent way to prevent the spread of disease, but of course the cattlemen do not take this into consideration.

No, I want to see this evidence of destruction put down in black and white. Perhaps Mr. Bailey or Major Goldman has it in convincing form, but neither one of them has shown it to us. It seems to us decidedly odd that if this evidence be so readily available the Biological Survey has been unable during the past 14 years to spend $1000 for placing it in print, while spending 10 millions for destruction.

And we are very anxious to know upon what sort of evidence the Biological Survey conclusions in regard to the harmful nature of coyote food is based. Mr. Young has told me that he places a far higher value on the food habits reports made by his hunters than upon laboratory analysis. We do not agree with him. In the first place the hunters are not only untrained in precision methods, but it is to their very definite advantage to make the coyote out as the worst possible citizen. We know for a fact that some hunters set traps with meat of domestic stock, chicken heads etc. for bait and then report domestic animal remains in the stomach of their victims. Perhaps only 5 per cent do, and then again this may be the action of 90 per cent. Some report domestic stock destruction when a hungry coyote has merely been gnaw-

ing on the dried carcass of a steer long dead. Is it 5 or 90 per cent who do this? Some merely twirl a stick in the stomach contents to see if any sheep hair adheres. Is it 5 or 90 per cent who take this action? Any laboratory worker who has studied stomach contents microscopically knows how many errors may be made by even the most experienced field worker when reporting stomach contents. In the case of bird stomachs Mr. McAtee regards field analysis as almost worthless, even when made by an experienced naturalist. We want the same yardstick applied to mammals as to birds. In the past, and with birds, the Biological Survey apparently has regarded it as almost a crime to label any bird as destructive without a painstaking and disinterested analysis of its food. Do you know how many such analyses of carnivore stomachs, of all species, have been made in Mr. McAtee's division in the past 40 years? Less than one dozen. And still the Biological Survey is making the claim that research on coyote food habits is being pushed. By this it is evidently meant that whenever Mr. Bailey or Major Goldman encounters a coyote in the field the stomach is examined. The hunters report stomach contents, of course, but we have seen how much scientific value this evidence is likely to have. Otherwise, so far as we know, the only research now being prosecuted is at the Denver laboratory. This concerns itself solely with how to kill coyotes and other animals more cheaply and quickly.

But there is another aspect to this matter. Prior to 1916 one frequently encountered in Biological Survey publications statements like the following: "The constant warfare of the coyote upon these rodents has much influence in keeping down their numbers, and the growing abundance of rabbits in some sections of the west has been attributed to the destruction of coyotes as the result of the high bounties offered for them"; and "coyotes perform a valuable service to man", (Lantz, 1905). Also that in parts of the west "it may be wise to encourage coyotes and bobcats within certain limits". Coyotes, "if unmolested will free their premises of rabbits and other crop or tree destroyers". "Many ranchers would almost as soon shoot their own dogs and cats as their wild benefactors". (Fisher, 1908).

Now I have not read all Biological Survey publications word for word, but in a diligent search I have been unable to find any such statements in defense of the coyote since 1916. There are a few feeble admissions that the coyote kills some rodents; and I know that in at least one instance a word in defense of the coyote has been summarily deleted from a Biological Survey manuscript. In other words, baldly

stated, the coyote admittedly did a lot of good prior to 1916, but none since appropriations have become available for its control. This leaves a disagreeable taste in the mouth. We vigorously object to the stressing of coyote damage to the amount of $50 per year without any mention at all that this is at least partially offset by beneficial habits. Such half truths issued by a scientific bureau are as deplorable as wilful misstatements. We believe that this is a practice of which the Biological Survey could hardly have been guilty fifteen years ago. As it thus becomes clear that the coyote is not being given an impartial deal, we cannot have implicit confidence that other forms of wild life are not being similarly treated, and whether we will or no, we are rendered suspicious of other statements.

The statement is constantly made by the Biological Survey that its policy is not one of extermination but only one of moderate control. Now I strongly object to being assured that the Biological Survey policy is one thing when the policy of the field force is quite different. Thus we read in Biological Survey publications such statements as the following: "If western ranges are ever to be entirely cleaned of predatory animals, etc.", "These men work to get the last individual", and "in Wyoming 2,800,726 acres have been systematically treated to eliminate all rodents and predatory mammals" (Day, 1929). Laythe, 1930, admonishes one of his hunters to "get 'em all, Tom, they are killers". On June 25, 1922, the last prairie dog was killed in Cochise and Graham counties, Arizona (Chief's report, 1922) and in 3 years 5 million of them were killed in this state alone. It was expected that by the end of 1928 the last prairie dog would have been exterminated in Kansas (Chief's report, 1928).

In spite of assurances to the contrary it is inevitable that the hunters should try for extermination. There are doubtless many splendid men among them but they are paid to kill and must be born killers, as are so many private hunters, or they would not stay with this sort of job, whose pay, I am told, is mostly about $4.00 per day. They are praised for a big bag of coyotes and the competitive spirit is fostered by praise put out in mimeographed form. When the average hunter will shoot at anything alive that he encounters why should we expect the federal hunter to behave very differently?

Although so many of us doubt the wisdom of killing so many coyotes, I venture to state that hardly one of us would be incited to active protest against the killing of 100,000 coyotes per year, *if* nothing but coyotes suffered. To me, the latter condition is our most serious indictment.

Killing is accomplished chiefly by the use of poison—strychnine hidden in small cubes of fat or meat and in 1924 over three and a half million of these baits were used. The claim is made that these are distributed where coyotes only can get them, and that the cubes not immediately taken are recovered. One grows exasperated at having his intelligence so lowly rated. In the first place poison can never be anything but indiscriminate. If an area be thoroughly poisoned for coyotes it is thoroughly covered for everything that will take the bait, and the coyote, being the wariest, is the last to take it. Poison cubes less than an inch square can not be completely, or even largely, recovered from the great open spaces. And are they so carefully placed as we are led to believe? One Idaho hunter ran a poison line 700 miles long covering 5000 square miles. Could this mileage be covered by careful work? The only result possible was that every single carnivore over this area of 5000 square miles was endangered and many of them killed. Two other men in Utah ran a poison line 300 miles long. They were praised for their initiative and others were thus spurred to do likewise.

And still the Survey claims that among the predatory mammals killed only three per cent are beneficial fur bearers. Although the estimate of coyotes poisoned but not found has run as high as 100,000 per year, we would be led to believe that *all* of the smaller skunks, foxes, *et cetera*, *are* found. It is most edifying to encounter at the present day such implicit faith in human nature as the Biological Survey places in its hunters. When Mr. Dixon's experience, which I just read to you, was brought to the attention of the Chief he at first would not believe it, and then admitted that it might be an isolated instance. Its importance has been thus depreciated ever since, and recently, upon my continued solicitation that Mr. Dixon publish his experiences, the request was made that he delay publication still longer as it might embarass the Biological Survey. Dr. Hall's findings were also called isolated instances, as was the similar evidence of Mr. Oliver in connection with the Buena Vista mouse plague. And the cry of isolated instances and irresponsible mischief-makers is raised to heaven when I point out the evidence contained in almost a hundred letters received by the California Department of Fish and Game from despairing trappers, which I read last summer. All these were laments to the effect that a government trapper has just been here and the fur is all gone. One found as many as 8 poisoned skunks in one place, another 8 dead raccoons and 6 foxes; 3 skunks and one badger at one poison station and 4 skunks at two more; 30 skunks along one small stream where a government poisoner had just

worked; 20 or 25 dead foxes and raccoons, and 19 raccoons in Pope's Valley; in one week in Payne's Creek district 105 skunks were thrown away by a federal trapper; and so on. We will concede that there is some chaff with the wheat, and that a deal of poisoning, learned from federal hunters, is done by private trappers, but these would hardly have discarded the animals before skinning. But the Survey's stand that the testimony of the private trapper is worthless, while all their own hunters are trustworthy, is hardly convincing logic to a grown man.

This implied attitude of the federal hunter is not to be wondered at. From my experience with the few I have met I cannot agree with the exalted opinion voiced by Mr. Young, in the book which he wrote with Mr. Carhart, that federal hunters are *"friends of all animals, the compassionate, regretful executioners of animal renegades when such outlaws must die that other wildlings may live."* They are hired to kill and their jobs depend upon killing. What is a skunk or badger to them but vermin which gets into their traps and prevents them from taking so many more coyotes! Rather than turn the beasts loose they knock them in the head, that they may be bothered no more!

So common sense tells us that to poison, or even trap coyotes means killing other carnivores wholesale, and we have proof that at least some of the trappers' reports are falsified. We would like to know if this incidental destruction is as great as, or twice as great as, the coyote kill. It may well be the latter figure, for poisoning can never be anything but indiscriminate. But poisoning was started because it is the quickest and cheapest method of killing great numbers, and the Survey would be very loath to change its methods, for some time would be lost. Trapping is almost as indiscriminate as poisoning, and it is impracticable to shoot coyotes by still-hunting. But they may easily be run with hounds and then shot, as I myself have found, and a good man with a few good dogs could without difficulty secure 25 coyotes per month, which I am now informed is the kill per hunter by present methods.

We are told that federal hunters operate only where there has been complaint of damage. This they will do first and then go wherever they think they can catch the most coyotes, often to be run off by an irate rancher. They operate regularly in places in California where they are neither needed nor wanted, and in addition, break the state law. A California law reads: "It shall be unlawful for any person to use poison of any kind in the taking or killing of any fur bearing animal." That means it is against the law to leave poison where a carnivore might eat

it. I asked a high official of the California Game Commission why this law breaking by the Biological Survey was tolerated. It is because of the sheep men, he said. If we should clamp down on the Survey the sheep men would see that every conservation measure which we introduced in the state legislature was promptly killed. So there you are.

We get constant evidence from naturalists who have been here and there in the west that they have visited areas where poisoners had worked and made the region almost a faunal desert. Over large areas of the west carnivores have been practically exterminated and some of them can never come back.

The claim is now boldly made by the Biological Survey that carnivores have little or no effect upon the rodent population. This is fairly breath-taking. Upon what do carnivores subsist in the great stretches of the west where the small game has been shot out and where there is no small domestic livestock? I agree with them that carnivores could never eliminate rodent "plagues" entirely, but the evidence to us is strongly suggestive that carnivores and hawks in reasonable numbers are instrumental in reducing the severity of such outbreaks as that in Kern County, California, in 1926, two years after a coyote campaign had been waged in the same area, and that of South Dakota in 1928, when the freshly planted grain over 40,000 acres was destroyed. It would take many, many dead sheep to equal this loss.

Even if carnivores do not prevent these occurrences entirely, what of it? Because we have infestations of grasshoppers and the brown-tail moth is that a reason to kill all of our insectivorous birds? I was talking not long since with a senator who had been in recent conversation with one of the very highest Biological Survey officials. This official offered as a Survey belief that it was of little moment if the furbearers were exterminated during coyote poisoning because the future of the fur industry lay with fur farming. This idea may have been garbled and I sincerely hope that it was.

I do not believe that many of you who have not done field work in the west can appreciate the number of rodents that often occur. Not infrequently practically every collecting trap will be sprung. Ground squirrels, pocket gophers and kangaroo rats often swarm, and jack rabbits are legion. Walter P. Taylor's experiments indicate that one million jack rabbits eat as much as about 53,000 sheep or 17,000 steers. Some of the statistics on jack rabbit kills offered by the Biological Survey are quoted. In one Oregon county there were poisoned 75,000 jack rabbits; in four counties 350,000; 334,000 were poisoned on

128,000 Utah acres; 100,000 on 8000 acres; 168,166 in Lincoln County, Idaho, and so on. Do we need every ally we can get to control these?

Now I like to see rodents skipping over the landscape with the best of them, but rodent taxes are levied grain by grain upon every single farmer in the United States, and in tens of thousands of instances they turn profit into loss, to the aggregate extent of several hundred million dollars a year. Wise rodent control is very much worth while. None of us approves of exterminating the prairie dog over an entire state, all of us would like to see a conscientious effort to establish safeguarded poison stations of the self feeder sort where practicable, instead of scattering the poisoned grain broadcast, and all of us deplore the half truths offered in this branch of the work as well, whereby it is stressed that gallinaceous birds are immune to the effects of strychnine, while at the same time a very soft pedal is put on the fact that every other bird of seed-eating habit, including doves and the like, is practically eliminated from poisoned areas.

But western badgers, skunks, raccoons, kit foxes and their ilk are tireless hunters of rodents, and even if one ignores their value as fur bearers, their services to agriculture are almost beyond price. If they are eliminated, as now is threatened over large areas, the results may be fairly as disastrous economically as now obtains with the rabbits of Australia. If man undertakes to take over the job of rodent control completely and with no help from their natural enemies, he will find it much like sweeping back the tide.

Just before Dr. Nelson's retirement as chief of the Survey he made financial and other arrangements to have Joseph Dixon investigate the destruction of fur bearers and other unfortunate results of coyote poisoning. Dr. Nelson sincerely wished to see this work done, as I happen to know, and it was upon the actual verge of initiation, when suddenly the whole matter was dropped. We are told that the money was not available, but again it seems odd that the $350 could not be found to complete the fund for learning true facts while ten millions were being spent for destruction; and if the Survey had really wanted the work done we could have helped find the money, as its officials well knew.

Because rodent control is advisable it may be foolish to kill off so many coyotes, but it is folly of the maddest type to kill coyotes by poison in such a way that other carnivores are at the same time destroyed. It is too much like swatting flies with one hand and breeding more flies with the other. I am sure that if the public knew the facts it would not tolerate such folly for a moment. Most of the game has been killed by

the hunters, and the Biological Survey field men are after all of the rodents and all of the carnivores. What will remain to us of our faunal heritage but insectivorous song-birds?

For a number of years, now, wild life matters have been going from bad to worse. There have been some reforms, coming almost if not quite too late to save the game, but other evils have newly arisen. We are now faced with the necessity of saving our non-game species. We are told that the procupine damages the forests and must be killed, the nests of the wood rat constitute a fire hazard and must be eliminated, and badger holes are dangerous to horses and the animals should be destroyed (as were actually 1450 of them in Wyoming by federal hunters in 11 years, and we know not how many more unreported). At any moment there is danger that some one will arise to label some additional species as destructive and successfully demand its elimination.

There are strong indications that we are now at a crisis—at the cross-roads of conservation as concerns treatment of our wild life. Conditions have been growing intolerable, but there is clearly evident a gathering storm of resentment that should accomplish many reforms. It rests entirely in the hands of such organizations as this Society to determine just what these results shall be and how soon they shall be accomplished.

We, here, are concerned with mammals. The Biological Survey is potentially the most powerful single factor, for good or evil, that we have in this field. For many years it was the respected and trusted public guardian of our fauna, but whether we will or no, conditions are now such that we are forced to label it not our federal wild life warden, but the guardian of the sheep men and other powerful interests.

I, for one, am working for the following points:

[No violation of State laws.]

A change in the attitude of the Biological Survey toward wild life, involving—

An impartial viewpoint; not stressing damage done by a species and under-rating its benefits, for purposes of policy.

A return to its former policy of recommending control only after adequate research and report.

Insistence that actions of field men conform to stated office policy.

Curtailment of predatory animal control where not clearly needed.

Abandonment of destructive poison operations against predatory mammals (save in an emergency) in favor of a less dangerous method of control.

A sincere effort to control rodents by some other method of poisoning than by the broadcasting of poisoned bait.

If a change should come in the present attitude of the Biological Survey toward wild life, then the other reforms, so sorely needed, would naturally follow.

Now, gentlemen, what is your pleasure? What are you going to do about it?

VICE-PRESIDENT PALMER: Discussion is in order.

MR. CAREY: Mr. Chairman, I should like to call the attention of the gentlemen here to the fact that the coyote extermination involves still another kind of poisoning which we have just learned about. The ramifications of it seem to be endless. According to the Bulletin Number 24 of the Department of Agriculture, October, 1927, they in a single year poisoned 5000 magpies. It was felt that this had to be done as the magpies interfered with the traps set for the coyotes. As a result the Department says, "Campaigns of magpie extermination (they use the term "extermination") often must be carried out before successful work in coyote control can be conducted."

I wonder how many other species of birds were poisoned besides the 5000 magpies in one year.

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LIST OF MEMBERS OF THE AMERICAN SOCIETY OF MAMMALOGISTS

(Corrected to May 23, 1930)

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MERRIAM, DR. C. HART, 1919 16th St., Washington, D. C.....(Charter) 1930
*NELSON, DR. E. W., Cosmos Club, Washington, D. C.....(Charter) 1930
OSBORN, DR. HENRY F., American Museum of Natural History, New York City.....(Charter) 1929
WEBER, PROF. DR. MAX, Eerbeek, Holland..... 1928

Members

ABBOTT, CLINTON G., Natural History Museum, San Diego, Calif..... 1922
*ABBOTT, DR. WILLIAM L., North East, Md.....Charter
ACKLAND, MYRON, Rosemary Farms, Monticello, N. Y..... 1926
ADAMS, DR. CHAS. C., State Museum, Albany, N. Y.....Charter
ADDISON, RICHARD A., 2115 W. 85th St., Los Angeles, Calif..... 1927
AGERSBORG, DR. H. P. KJERSCHOW, Shepard College State Normal School, Shepardstown, W. Va..... 1921
AHRENS, RAYMOND M., 2513 Lincoln Avenue, Chicago, Ill..... 1929
AHRENS, DR. THEODOR G., Waitzstr. 24. III, Charlottenburg. 4, Berlin, Germany..... 1921
AINSWORTH, MAJ. GEN. F. C., The Concord, Washington, D. C..... 1921
AKELEY, MRS. MARY L. J., American Museum Natural History, New York City..... 1928
ALBRIGHT, DR. HORACE M., 4920 Indian Lane, N. W., Washington, D. C.....Charter
ALDOUS, SHALER E., 208 French Bldg., Albuquerque, New Mex..... 1927
*ALEXANDER, MISS ANNIE M., Suisun, Calif.....Charter
ALEXANDER, E. GORDON, c/o Mrs. T. A. Mims, 140 Grove Ave., Woodbridge, N. J.....Charter
ALLEN, DR. ARTHUR A., McGraw Hall, Ithaca, N. Y.....Charter
ALLEN, FRANCIS H., 2 Park St., Boston, Mass..... 1923
*ALLEN, DR. GLOVER M., Museum of Comparative Zoology, Cambridge, Mass.....Charter
*ALLIS, DR. EDWARD P. JR., Palais de Carnoles, Menton, France..... 1922
ALLISON, VERNON C., Picatinny Arsenal, Dover, N. J..... 1930
AMORY, COPLEY, 1811 Q Street, N. W., Washington, D. C..... 1928
ANDERSEN, THANNING W., Bessey Hall, State Univ., Lincoln, Neb..... 1929
ANDERSON, EDWARD C., 1220 W. Franklin St., Richmond, Va..... 1930
ANDERSON, DR. RUDOLPH M., National Museum of Canada, Ottawa, Canada.....Charter
ANDREWS, CLEMENT W., 86 E. Randolph St., Chicago, Ill..... 1926
ANDREWS, ROY C., 2 Kung Hsien Hutung, Peiping, China.....Charter
ANTHONY, A. W., 2533 University Ave., San Diego, Calif.....Charter

ANTHONY, H. E., American Museum of Natural History, New York City.....Charter
APGAR, CHARLES S., JR., Earle Apt. 5, Pittsburgh, Pa..... 1927
*ARCHBOLD, RICHARD, 26 Broadway, New York City..... 1929
ARMSTRONG, EDWARD E., 1056 Loyola Ave., Chicago, Ill..... 1925
ARTHUR, STANLEY C., 1309 State St., New Orleans, La..... 1925
ASCHEMEIER, C. R., Florida State Museum, Gainesville, Fla.....Charter
ASHBROOK, FRANK G., U. S. Biological Survey, Washington, D. C..... 1922
*ATKINSON, HARRY W., 10 Bishop Road, Guilford, Baltimore, Md..... 1925
AUGUSTIN, E. R., JR., 161 Summit Ave., Upper Montclair, N. J..... 1928
AUSTIN, OLIVER L., JR., Great Lakes States Experiment Station, Univ. Farm, St. Paul, Minn..... 1930
AXLEROD, ABRAHAM, 620 Broadway, Buffalo, N. Y..... 1927
BABCOCK, DR. HAROLD L., Woodleigh Road, Dedham, Mass.....Charter
BACH, DR. GLENN R., State Capitol Bldg., Olympia, Wash..... 1924
BADÉ, DR. WILLIAM F., 2616 College Ave., Berkeley, Calif.....Charter
BAETJER, Dr. EDWIN G., 1409 Continental Bldg., Baltimore, Md..... 1930
BAGGLEY, GEO. F., National Park Service, Yellowstone Park, Wyo..... 1929
BAILEY, ALFRED M., Chicago Acad. Sci., Chicago, Ill.....Charter
BAILEY, BERNARD, San Marcos, Calif.....Charter
BAILEY, FLORENCE M., 1834 Kalorama Road, N. W., Washington, D. C.....Charter
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BAILEY, JOHN W., Univ. of Richmond, Richmond, Va..... 1927
*BAILEY, VERNON, 1834 Kalorama Road, N. W., Washington, D. C.....Charter
BAIRD, KATHARINE B., 815 Webster St., N. W., Washington, D. C.....Charter
*BALDWIN, S. PRENTISS, 11025 East Boulevard, Cleveland, Ohio..... 1922
BALL, EDWARD M., East Falls Church, Virginia.....Charter
BALL, WILLIAM H., 1861 Ingleside Ter. N. W., Washington, D. C..... 1925
BALLOU, DR. W. H., Alpine Road, Closter, N. J..... 1926
BANGS, OUTRAM, Museum of Comparative Zoology, Cambridge, Mass. Charter
*BANNON, HENRY, First National Bank Bldg., Portsmouth, Ohio..... 1925
*BARBOUR, DR. THOMAS, Museum of Comparative Zoology, Cambridge, Mass.....Charter
BARNES, CLAUDE T., 359 10th Ave., Salt Lake City, Utah.....Charter
BARRETT, CHARLES H. M., 1339 Valley Place, S. E., Washington, D. C. Charter
BARTLETT, ILO H., Dept. of Conservation, Lansing, Mich..... 1930
BARTSCH, DR. PAUL, U. S. National Museum, Washington, D. C..... 1921
BASSETT, FRANK N., 91 Merced Ave., San Francisco, Calif..... 1921
BASSLER, DR. HARVEY, Iquitos, Amazon River, Peru, S. A..... 1929
BATCHELDER, CHAS. F., 7 Kirkland Street, Cambridge, Mass.....Charter
BAUMAN, JOHN E., New Lincoln Hotel, Lincoln, Ill..... 1923
*BEACH, WILLIAM N., 131 East 46th St., New York City.....Charter
BEEBE, WILLIAM, 33 W. 67th St., New York City.....Charter
BELL, JAMES F., 2215 Park Avenue, Minneapolis, Minn..... 1921
BELL, Dr. W. B., 803 Rittenhouse Street, N. W., Washington, D. C...Charter
BENSLEY, PROF. B. A., University of Toronto, Toronto, Can..... 1921

BENSON, JOHN T., Nashua, N. H. 1923
BENSON, SETH B., Mus. Vert. Zool., Berkeley, Calif. 1928
BENT, A. C., Taunton, Mass. 1926
BERGTOLD, DR. W. H., 1159 Race Street, Denver, Colorado ..... Charter
BERMINGHAM, EDWARD J., 620 N. Mayflower Ave., Lake Forest, Ill. 1930
BERRY, ELVERTON C., Box 234, Conway, N. H. 1924
BERTELMAN, S. J., Gravenhage 5, Hague, Netherlands 1930
BEYE, DR. HOWARD L., 422 Brown St., Iowa City, Iowa 1930
BIBB, DR. J. PORTER, 111 Moulton Street, Montgomery, Alabama 1921
BICKNELL, MRS. F. T., 319 S. Normandie Ave., Los Angeles, Calif. 1926
BIERMAN, WILLEM H., Blesboklaan 6, Hilversum, Holland 1930
BINGHAM, DR. HAROLD C., Inst. of Psychology, Yale Univ., New Haven, Conn. 1924
BIRD, RALPH D., Dept. of Zoology, Univ. of Oklahoma, Norman, Okla. 1926
BISHOP, DR. LOUIS B., 450 Bradford St., Pasadena, Calif. 1927
BISHOP, DR. SHERMAN C., Dept. of Biology, Univ. of Rochester, Rochester, N. Y. ..... Charter
BLAAUW, DR. F. E., Gooilust, 'sGraveland, Hilversum, Holland 1921
BLACK, PROF. DAVIDSON, Dept. of Anatomy, Peking Union Medical College, Peking, China ..... Charter
BLAIN, DR. ALEX. W., 2201 Jefferson Ave. E., Detroit, Mich. 1926
BLAIR, DR. W. REID, N. Y. Zoological Society, New York City 1927
BLAKE, PROF. IRVING H., Dept. of Zoology, Univ. of Nebraska, Lincoln, Neb. ..... Charter
BLANCHARD, DR. FRANK N., Dept. of Zoology, Univ. of Michigan, Ann Arbor, Mich. 1923
BLISS, JOHN D., Pozo, San Luis Obispo Co., Calif. 1926
BLOSSOM, PHILIP M., 2002 Gedder Ave., Ann Arbor, Mich. 1929
BLUNTSCHLI, PROF. HANS, Holbeinstr. 31, Frankfort, Germany 1930
BOESEL, M. W., 415 S. Washington St., New Bremen, Ohio 1926
BOKER, PROF. DR. HANS, Anatomische Institut, Frieburg, Germany 1930
BOLE, BENJAMIN P., JR., Lake Shore Blvd. & Bratenabl Rd., Cleveland, Ohio 1930
BOLT, BENJAMIN F., 225 E. 46th Street, Kansas City, Mo. ..... Charter
*BORDEN, JOHN, 33 N. Lasalle St., Chicago, Ill. 1928
BORELL, ADREY E., 753 56th St., Oakland, Calif. 1925
BOWDISH, BEECHER S., Demarest, N. J. 1921
BOWEN, WILFRED W., Acad. Nat. Sci., Logan Square, Philadelphia, Pa. 1929
BOYDEN, ALAN, Stelton, N. J. 1926
BRADLEY, ROBERT MCL., Museum of Zool., Ann Arbor, Mich. 1928
BRADSHAW, F., Director Provincial Museum, Normal School, Regina, Saskatchewan, Canada ..... Charter
BRADT, G. W., Zoology Dept., Mich. State College, East Lansing, Mich. 1927
BRANDES, DR. GUSTAV, Tiergartenstr. 1, Dresden, Germany 1930
*BRANDRETH, COURTENAY, Ossining, N. Y. 1921
BRANNON, PETER A., Box 358, Montgomery, Ala. ..... Charter
BRECK, MRS. EDWARD, 2330 Mass. Ave., Washington, D. C. 1930
BREWER, J. B., 2178 Madison Avenue, Indianapolis, Ind. 1927

BRIGHAM, EDWARD M., 25 E. Van Buren St., Battle Creek, Mich..... 1925
BRIMLEY, C. S., 515 Washington St., Raleigh, N. C.....Charter
BRIMLEY, H. H., State Museum, Raleigh, N. C.....Charter
BRINKMANN, DR. AUGUST, Bergen Museum, Bergen, Norway..... 1921
BRODE, PROF. H. S., 433 E. Alder St., Walla Walla, Wash.....Charter
BRONGERSMA, L. D., Bloemendaalscheweg 84, Bloemendaal, Holland..... 1930
BROOKS, ALLAN, Okanagan Landing, British Columbia.....Charter
BROOKS, EARLE A., 166 Plymouth Road, Newton Highlands, Mass..... 1921
BROOKS, FRED E., French Creek, West Virginia.....Charter
BROWN, BARNUM, American Museum of Natural History, New York City 1926
BROWN, C. EMERSON, Philadelphia Zoological Garden, Philadelphia, Pa.....Charter
BROWN, E. J., 3722 Cornelia Drive, Coconut Grove, Miami, Fla.....Charter
BROWN, F. MARTIN, Fountain Valley School, Colorado Springs, Colo..... 1926
BROWN, ORVILLE H., Box 233, Manor, Westmoreland Co., Pa..... 1927
BROWN, T. WISTAR, 3rd., 5920 City Avenue, Overbrook, Pa..... 1924
BROWN, WM. L., U. S. National Museum, Washington, D. C.....Charter
BRUUN, CHARLES A., 1510 Central Avenue, Hot Springs, Ark.....Charter
BRYANT, CHARLES A., 150 Franklin St., San Francisco, Calif..... 1926
BRYANT, DR. HAROLD C., National Park Service, Washington, D. C.....Charter
BRYANT, WILLIAM L., Park Museum, Roger Williams Park, Providence, R. I..... 1922
BUHN, MRS. MINNIE, 3027 60th Avenue, Oakland, Calif..... 1925
BULL, CHARLES L., Oradell, N. J..... 1926
BULLOCK, D. S., El Verjel, Angol, Chile..... 1921
BUMSTEAD, Col. DALE, 14 W. McDowell Road, Phoenix, Arizona.....Charter
BURDEN, WILLIAM D., American Museum of Natural History, New York City..... 1928
BURGESS, THORNTON W., 61 Washington Road, Springfield, Mass.....Charter
BURLEIGH, THOMAS D., 612 City Hall, Asheville, N. C..... 1930
BURNETT, WM. L., State Agricultural College, Fort Collins, Col..... Charter
BURNHAM, JOHN B., Essex, N. Y..... 1923
BURNS, FRANK L., Berwyn, Pa.....Charter
BURRELL, HARRY, La Mascotte, Doncaster Ave., Kensington, N. S. W., Australia.....Charter
BURRELL, MRS. HARRY (SUSAN EMILY), La Mascotte, Doncaster Ave., Kensington, New South Wales, Australia.....Charter
BURT, DR. WILLIAM H., Museum of Calif. Inst. of Technology, Pasadena, Calif..... 1926
BUSH, H. G., Foxworth-Bush Lumber Co., Mesa, Ariz..... 1927
BUTLER, DR. AMOS W., 52 Downey Ave., Irvington, Indianapolis, Ind.....Charter
CABOT, WILLIAM B., 447 Marlboro Street, Boston, Mass..... 1922
CABRERA, ANGEL, Museo de la Plata, La Plata, Argentina.....Charter
CADWALADER, CHARLES M. B., Fort Washington, Pa..... 1930
*CADWALADER, DR. WILLIAMS B., 133 S. 36th St., Philadelphia, Pa..... 1924
CAHALANE, VICTOR H., Univ. Museums, Ann Arbor, Mich..... 1930
CAHN, DR. ALVIN R., 431 Natural History Bldg., Urbana, Ill..... 1921

CALDWELL, GEORGE T., 5520 Ellis Ave., Chicago, Ill..... 1922
CALINESCU, DR. PAUL I., Academiei 14, Bucharest, Rumania..... 1930
CAMPBELL, DOUGLAS, Rathbone Place, Grosse Pointe Village, Mich..... 1930
CAMPBELL, DR. J. A., 13 Elm Street, Toronto, Ontario, Can..... 1920
CANTRALL, CHARLOTTE V., 2021 Woodside Road, Ann Arbor, Mich..... 1930
CANTWELL, GEORGE G., 3602 Keystone Ave., Palms, Calif.....Charter
CAREY, HENRY C., 3115 Queen Lane, Queen Lane Manor, Phila., Pa..... 1926
CARLISLE, GEORGE L., JR., Norfolk, Conn..... 1926
CARLSON, C. O., Dept. of Biology, Doane College, Crete, Neb..... 1926
CARPENTER, CHARLES K., 10920 S. Hoyne Ave., Chicago, Ill..... 1926
CARR, WILLIAM H., American Museum of Natural History, New York City..... 1926
*CARROLL, JAMES J., 16 Courtland Place, Houston, Texas..... 1926
CARROLL, DR. MITCHEL, Franklin & Marshall College, Lancaster, Pa..... 1922
CARTER, HON. GEO. R., 472 Judd St., Honolulu, T. H..... 1927
CARTER, T. DONALD, American Museum of Natural History, New York City..... 1922
CASAMAJOR, PROF. LOUIS, College of Physicians & Surgeons, New York City..... 1922
CASE, DR. E. C., Univ. Museums, Ann Arbor, Mich.....Charter
CASTLE, DR. WILLIAM E., 186 Payson Road, Belmont, Mass..... 1930
CHAMBERLAIN, EDWARD B., 182 Ashley Avenue, Charleston, S. C..... 1923
CHAMBERS, W. LEE, 2068 Escarpa Drive, Eagle Rock, Calif.....Charter
CHAPIN, DR. JAMES P., American Museum of Natural History, New York City.....Charter
CHARTERS, EMMA M., U. S. Biological Survey, Washington, D. C..... 1921
CHASE, HENRY B. JR., Natural History Bldg., New Orleans, La..... 1924
CHASE, DR. WILL, Empress Bldg., Cordova, Alaska..... 1927
CHEESMAN, WILLIAM H., U. S. Biological Survey, Washington, D. C...Charter
CHILD, SARGENT, U. S. National Museum, Washington, D. C..... 1930
CHRISTY, BAYARD H., 403 Frederick Ave., Sewickley, Pa..... 1926
CHURCH, MORTON L., Box 1236, Charlotte, N. C.....Charter
CHURCHILL, EDWARD T., 415 S. University, Vermillion, S. D..... 1930
CLARK, ELTON, 18 Post Office Square, Boston, Mass.....Charter
CLARK, JAMES T., American Museum of Natural History, New York City..... 1926
CLARK, R. F., 209 E. Ariz. Ave., Ruston, La..... 1926
CLARK, WM. O., Framingham Centre, Mass.....Charter
CLEAVES, HOWARD H., St. George Gardens, Staten Island, N. Y..... 1923
CLEMENTS, DR. FREDERIC E., Mission Canyon, Santa Barbara, Calif..... 1927
COCHRAN, MISS DORIS M., U. S. National Museum, Washington, D. C.... 1925
COCKERELL, PROF. T. D. A., 908 Tenth St., Boulder, Colorado.....Charter
*COFFIN, H. E., 2335 First National Bank Bldg., Detroit, Mich..... 1924
*COLBURN, ALBERT E., 716-718 S. Flower St., Los Angeles, Calif.....Charter
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COLEMAN, ROBERT H., 4 Green Street, Charleston, S. C..... 1928
COLLINS, A. M., A. M. Collins Manufacturing Co., Philadelphia, Pa..... 1921

COLLINS, DR. HOMER H., Dept. of Zoology, Univ. of Pittsburgh, Pittsburgh, Pa. 1921
*COLTON, HAROLD S., Box 127, Flagstaff, Ariz. 1927
COMPTON, LAWRENCE V., Museum of Vertebrate Zoology, Berkeley, Calif. 1929
CONGER, PROF. ALLEN C., Ohio Wesleyan Univ., Delaware, Ohio. ..... Charter
CONNER, A. B., Director Texas Agric. Experiment Station, College Station, Texas 1930
COOK, MISS FANNYE A., Crystal Springs, Miss. 1925
COOK, HAROLD J., Agate, Sioux County, Neb. 1925
COOKE, MISS MAY T., 2572 University Place, Washington, D. C. ..... Charter
COOKMAN, ALFRED, 909 Bradford St., Pomona, Calif. 1926
COOLIDGE, DANE, Dwight Way End, Berkeley, Calif. ..... Charter
COOLIDGE, HAROLD J., JR., 303 Berkeley St., Boston, Mass. 1926
COOLIDGE, JOHN T., JR., Green St., Readville, Mass. 1927
COOLIDGE, PHILIP T., 31 Central St., Bangor, Me. 1927
COPE, FRANCIS R., JR., Dimock, Pa. 1926
COPELAND, DR. MANTON, Bowdoin College, Brunswick, Me. ..... Charter
COTTAM, CLARENCE, U. S. Biological Survey, Washington, D. C. 1929
COUCH, LEO K., U. S. Biological Survey, State Capitol Bldg., Olympia, Wash. ..... Charter
COURTNEY, WILBUR D., 321 N. 21st St., Corvallis, Oregon. 1920
CRABB, EDWARD D., Dept. Biol., Univ. of Colo., Boulder, Colo. 1923
CRAIG, WILLIS G., 714 Alvarado St., Redlands, Calif. 1929
CRANDALL, FRANCIS, National Bank Bldg., Westfield, N. Y. 1930
CRANDALL, LEE S., N. Y. Zoological Park, New York City 1922
CRAVEN, J. W., 3719 Jenifer St., N. W., Washington, D. C. ..... Charter
CRAWFORD, LEWIS F., 220 Avenue A., West, Bismarck, N. D. 1925
CRIDDLE, NORMAN, Treesbank, Manitoba, Canada ..... Charter
CRIDDLE, STUART, Treesbank, Manitoba, Canada ..... Charter
CRITCHELL-BULLOCK, CAPT. JAMES, Explorers Club, New York City 1926
CROSS, W. REDMOND, 31 Pine Street, New York City 1922
*CUDAHY, JOHN, 95 E. Wis. Ave., Milwaukee, Wis. 1923
CURRY, HASKELL B., 805 W. Beaver Ave., State College, Pa. 1930
CUTLER, DR. IRA E., 2122 S. Clayton, Denver, Colo. 1926
*CUTTING, C. SUYDAM, 32 Nassau St., New York City 1930
CUYLER, WILLIAM K., Cleveland Mus., Cleveland, Ohio 1923
DAILEY, ELRIC J., Ogdensburg, N. Y. 1930
DALEY, FLORENCE K., Plaza San Pablo, C. P., Valencia, Spain 1927
DALKE, PAUL D., School of Forestry & Conservation, Univ. of Michigan, Ann Arbor, Mich. 1928
DAMMERMAN, KAREL W., Zoological Museum & Laboratory, Buitenzorg, Java ..... Charter
DANFORTH, STUART T., Colegio de Agric., Mayaquez, Porto Rico 1925
DAVENPORT, DR. CHAS. B., Cold Spring Harbor, Long Island, N. Y. 1921
DAVIDSON, MRS. M. E. MCLELLAN, 717 Lincoln Avenue, Palo Alto, Calif. 1926
DAVIS, D. DWIGHT, 105 S. Ellsworth St., Naperville, Ill. 1930
DAVIS, ELI, R. R. no. 7, London, Ontario, Canada 1930

DAVIS, R. N., Everhart Museum, Scranton, Pa. 1922
*DAVIS, WILLIAM T., 146 Stuyvesant Place, Staten Island, N. Y. 1922
DAY, ALBERT M., U. S. Biological Survey, Cheyenne, Wyo. 1924
DAY, DR. CAMERON D., 214 E. 5th St., Fulton, Mo. 1928
DE AGUILAR-AMAT, JUAN B., Museo de Ciencias Naturales, Barcelona, Spain 1924
DE BALZAC, HENRI H., 34 Rue Hamelin, Paris, 16e, France 1928
DEARBORN, DR. NED, School of Forestry & Conservation, Ann Arbor, Mich. ..... Charter
DEASON, HILARY J., Museum of Zoology, Ann Arbor, Mich. 1930
DE BEAUX, PROF. OSCAR, Via Brigate Liguria 9, Genoa, Italy 1930
DECK, RAYMOND S., Childrens Museum, 185 Brooklyn Ave., Brooklyn, N. Y. 1926
DEICHMANN, ELIZABETH, Museum Comparative Zoology, Cambridge, Mass. 1925
DELACOUR, DR. J., Chateau de Cleres, Seine-Inferieure, France 1926
DE LONG, CHARLES S., Lake Forrest, Ill. 1927
DE LONG, FREDERIC T., 1557 Railway Exchange Bldg., Chicago, Ill. 1930
DE LURY, RALPH E., Dominion Observatory, Ottawa, Canada 1925
DICE, DR. LEE R., Museum of Zoology, Ann Arbor, Mich. ..... Charter
*DICKEY, DONALD R., Calif. Inst. of Technology, Pasadena, Calif. ..... Charter
DICKINSON, FRANCIS R., 1518 Astor St., Chicago, Ill. 1930
DICKINSON, JOSEPH E., 409 N. Horsman St., Rockford, Ill. 1926
DILLE, FREDERICK M., Valentine, Nebraska ..... Charter
DILLEHUNT, HARRY B., JR., 3333 N. Charles St., Baltimore, Md. 1926
DITMARS, RAYMOND L., New York Zoological Park, The Bronx, New York City 1921
DIXON, JOSEPH S., Museum of Vertebrate Zoology, Berkeley, Calif. ..... Charter
DONAHUE, MRS. R. W., Peabody Museum Library, New Haven, Conn. 1930
DONALDSON, DR. HENRY H., The Wistar Institute, Philadelphia, Pa. ..... Charter
DOUGLAS, D. DWIGHT, First National Bank, Detroit, Mich. 1930
DOUGLAS, GEORGE M. Lakefield, Ontario 1923
DOUTT, J. KENNETH, Carnegie Museum, Pittsburgh, Pa. 1927
DOWNS, WILLIAM G., JR., Dept. of Pathology, Yale Medical School, New Haven, Conn. 1929
DRAYTON, J. COLEMAN, 7 Red Cross Ave., Newport, R. I. 1930
DU CHARME, HAROLD, 5 Lake Court, Grosse Pointe, Mich. 1928
DUFF, JOHN R., Public Works Dept., Christchurch, New Zealand 1925
DUNKELBERGER, HARRY W., P. O. Box 6, Flourtown, Montgomery Co., Pa. 1925
DUNN, PROF. E. R., Haverford College, Haverford, Pa. 1927
DUNN, DR. LESLIE C., Dept. of Zoology, Columbia Univ., New York City 1921
EANES, ROBERT H., 401 Park Pl., Austin, Texas 1924
EAST, CHARLES S., 635 Kenyon St., Washington, D. C. 1923
EASTWOOD, SIDNEY K., 301 S. Winebiddle Ave., Pittsburgh, Pa. 1929
EATON, PROF. E. H., 678 Main St., Geneva, N. Y. 1921
EATON, SCOTT H., Box 653, Lawrenceville, Ill. 1925

EDGE, MRS. CHARLES N., 113 E. 72nd St., New York City 1930
EDSON, FRANKLIN, III, Round Hill Road, Greenwich, Conn 1930
EDSON, JOHN M., 90 Marietta Road, Bellingham, Wash ..... Charter
EHIK, DR. JULIUS, Hungarian National Museum, Budapest, 80, Hungary 1923
EHRENREICH, DR. ALFRED, 7 Willow Road, Hamsptead Heath, London, England 1930
EICHWALDT, MRS. FLORENCE, 721 Sunset St., Hayward, Calif 1928
EIFRIG, C. W. G., 1029 Monroe Ave., River Forest, Ill ..... Charter
EKBLAW, W. ELMER, Box 431, North Grafton, Mass 1921
ELFTMAN, HERBERT, Scheimerhorn Hall, Columbia Univ., New York City 1926
ELLIOTT, MRS. JANE S., U. S. Biological Survey, Washington, D. C ..... Charter
*ELLIS, RALPH, JR., 2420 Ridge Road, Berkeley, Calif 1926
ELROD, PROF. MORTON J., 205 S. 5th St., E. Missoula, Mont ..... Charter
EMLEN, ARTHUR C., Awbury, Germantown, Philadelphia, Pa 1926
ENDERS, ROBERT K., Mo. Valley College, Marshall, Mo 1924
ENGLISH, PROF. PENNOYER F., Box 204, Main Bldg., A. & M. College, College Station, Texas 1922
*EVANS, VICTOR J., Ninth Street and Grant Place, N. W., Washington, D. C ..... Charter
EVARTS, HAL G., 200 S. Lorraine Blvd., Los Angeles, Calif 1925
EVERMANN, DR. BARTON W., California Academy of Sciences, San Francisco, Calif ..... Charter
EWING, DR. H. E., U. S. National Museum, Washington, D. C 1923
FARGO, WILLIAM G., 506 Union St., Jackson, Mich 1928
FEIGENSPAN, CHRISTIAN W., 24 Commerce St., Newark, N. J 1930
FELDMAN, DR. HORACE W., Dept. of Zoology, Univ. of Michigan, Ann Arbor, Mich 1928
FERGUSON, HARRY L., Pomfret School, Pomfret, Conn 1922
FERRAR, MAJ. B. B., Supt. Dublin Zoological Gardens, Phoenix Park, Dublin, Ireland 1927
FESTA, DR. ENRICO, Regio Museo Zoologico, Palazzo Carignano, (108) Torino, Italy 1925
FIGGINS, J. D., Colorado Museum of Natural History, Denver, Colo ..... Charter
FILLEY, OLIVER D., 49 Broad St., New York, N. Y 1930
FINCH, MILFORD L., 1427 N. 24th St., Kansas City, Kansas 1927
FINLEY, WILLIAM L., Jennings Lodge, Oregon ..... Charter
FISH, HAROLD D., 213 Southern Bldg., Washington, D. C 1924
FISHER, DR. A. K., The Plymouth, Washington, D. C ..... Charter
FISHER, MISS EDNA M., 2410 Fulton St., Berkeley, Calif 1928
FISHER, DR. G. CLYDE, American Museum of Natural History, New York City ..... Charter
FISHER, WALTER T., 949 Fisher Lane, Winnetka, Ill 1930
FLEMING, J. H., 267 Rusholme Road, Toronto, Can ..... Charter
FLOWER, MAJOR S. S., Tring, Herts, England 1921
FLOYD, CHARLES B., 454 Wolcott St., Auburndale, Mass 1926
FOLLETT, RICHARD E., 2134 Dime Bank Bldg., Detroit, Mich 1926
FOLLETT, WILBUR I., Apt. 3, 157 Ronada Ave., Piedmont, Calif 1927

FOLLIN, HON. MAYNARD D., P. O. Box 118, Detroit, Mich. 1930
FOSTER, FRANCIS A., RFD Box 31A, Vineyard Haven, Mass. 1922
FOSTER, FRANK B., P. O. Box H, Haverford, Pa. 1926
FOSTER, JOHN H., P. O., Box H, Haverford, Pa. 1927
FOX, DR. HERBERT, Zool. Soc. Phila., Phila. Pa. 1927
FRASER, DR. CHARLES M., University of British Columbia, Vancouver, British Columbia 1921
FRENCH, JAMES, G. 3628 Saanich Road, Victoria, British Columbia 1926
*FRICK, CHILDS, ROSLYN, Long Island, N. Y. ..... Charter
FRIEL, ARTHUR O., 726 Ocean Avenue, Brooklyn, N. Y. 1927
FRIESSER, JULIUS, Field Museum of Natural History, Chicago, Ill. 1924
FRYXELL, F. M. 713 3rd St., Moline, Ill. 1925
*FUGUET, HOWARD, Bullitt Bldg., Philadelphia, Pa. 1925
FULLER, ARTHUR B., 2717 Euclid Avenue, Cleveland, Ohio ..... Charter
FULLER, HENRY C., 3704 Huntington St., Washington, D. C. 1926
FURLONG, PROF. E. L., Calif. Inst. of Technology, Pasadena, Calif. 1925
GABRIELSON, IRA N., 515 Post Office Bldg., Portland, Oregon ..... Charter
GAGLE, ROY H., 1215 3rd Ave., North, Great Falls, Mont. 1924
GAIGE, FREDERICK M., Museum of Zoology, Ann Arbor, Mich. 1929
GAILLARD, PROF. C., Museum des Sciences Naturelles, Lyon, France 1925
GAMMAGE, ECTOR R., Westlake, La. 1927
GANDER, FRANK F., P. O. Box 395, East San Diego, Calif. 1927
GARLOUGH, F. E., 2254 Lawrence St., Denver, Colo. ..... Charter
GARRETSON, M. S., 3703 Willett Ave., New York City 1921
GATES, WM. H., University Station, Baton Rouge, La. 1930
GAULT, BENJAMIN T., 424 S. Main St., Glenellyn, Du Page Co., Ill. ..... Charter
GAUSEBECK, A. T., 60 Broadway, New York City 1926
GHIGI, PROF. ALESSANDRO, Dept. of Zoology, Univ. of Bologna, Bologna, Italy 1926
GIANINI, CHARLES A., Poland, N. Y. ..... Charter
GIDLEY, DR. JAMES W., U. S. National Museum, Washington, D. C. ..... Charter
GIFFORD, DR. HAROLD, 3636 Burt St., Omaha, Neb. 1926
GIGNOUX, CLAUDE, 73 Tunnel Road, Berkeley, Calif. 1926
GILBERT, KENNETH, Box 816 Issaquah, Wash. 1929
GILCHRIST, D. A., 134 S. Central Ave., Phoenix, Ariz. 1930
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GILMORE, DR. MELVIN R., Museum of Anthropology, Univ. of Michigan, Ann Arbor, Mich. ..... Charter
GILMORE, RAYMOND M., 2559 Le Conte Ave., Berkeley, Calif. 1926
GILPIN, F. ROBERT, 1212 S. 57th St., West Philadelphia, Pa. ..... Charter
GLENN, DONALD, Franklin, Pa. 1926
GLOYD, HOWARD K., Dept. of Zoology, Univ. Michigan, Ann Arbor, Mich. 1922
GOLDEN, DR. ISAAC J. K., 2238 W. North Ave., Chicago, Ill. 1928
GOLDMAN, MAJ. E. A., U. S. Biological Survey, Washington, D. C. ..... Charter
GOLDMAN, LUTHER J., Box 59, Pocatello, Idaho 1922
GOLDSMITH, G. W., Box 1611 Univ. Sta., Austin, Texas 1922
GOLDSMITH, DR. WM. M., Biology Department, Southwestern College, Winfield, Kansas 1924

GOODWIN, GEORGE G., American Museum of Natural History, New York City 1921
GOWANS, ETHEL, 308 S. Lincoln St., Kent, Ohio..... 1925
GRANGE, WALLACE B., 111 N. Hameton, Apt. 4, Madison, Wis..... 1923
GRANGER, WALTER W., American Museum of Natural History, New York City.....Charter
GRANT, CLEVELAND, Field Museum Natural History, Chicago, Ill..... 1926
GRANT, E. R., 2101 16th St., N. W., Washington, D. C..... 1923
*GRANT, MADISON, 101 Park Avenue, New York City.....Charter
GRANT, U. S., IV., P. O. Box 1050, Stanford Univ., Calif..... 1926
GRASS, PROF. ARTHUR M., 339 B. St., NE, Linton, Ind..... 1929
GRAY, A. E., 304 E. 12th St., Oklahoma City, Okla..... 1924
GREEN, PROF. GEORGE R., 511 S. Atherton St., State College, Pa..... 1925
GREEN, HAROLD T., Academy of Natural Sciences, Philadelphia, Pa..... 1927
*GREEN, MORRIS M., 39 South Wyoming Ave., Ardmore, Pa..... 1924
GREENFIELD, RAY H., 124 Maple Ave., Takoma Park, Md..... 1928
GREGORY, S. S., JR., 105 S. LaSalle St., Chicago, Ill..... 1927
*GREGORY, TAPPAN, 19 S. LaSalle St., Chicago, Ill..... 1925
GREGORY, DR. WILLIAM K., American Museum of Natural History, New York City.....Charter
GRIEPENTROG, ELMER, 485 N. 17th St., Salem, Ore..... 1926
GRIFFIN, DONALD, Barnstable, Mass..... 1929
*GRINNELL, DR. GEORGE B., 238 E. 15th St., New York City.....Charter
GRINNELL, DR. JOSEPH, Museum of Vertebrate Zoology, Berkeley, Calif.....Charter
GRINNELL, MRS. JOSEPH, 3016 Benvenue Ave., Berkeley, Calif..... 1923
GROMME, OWEN J., Milwaukee Public Museum, Milwaukee, Wis..... 1928
GROSVENOR, DR. GILBERT, Hubbard Memorial Hall, 16th & M. Streets, N. W., Washington, D. C..... 1921
GUTHRIE, MARY J., Lefevre Hall., Univ. of Missouri, Columbia, Mo..... 1930
GYLDENSTOLPE, COUNT NILS, Naturhistoriska Riksmuseum, Stockholm, 50, Sweden.....Charter
HAGERUP, H., Gothersgade 30, Copenhagen, Denmark.....Charter
HAGNER, DR. FRANCIS R., 1824 19th St., N. W., Washington, D. C..... 1925
HAIGHT, SHERMAN P., 19 Thomas St., New York City.....Charter
HALL, DR. E. RAYMOND, Museum of Vertebrate Zoology, Berkeley, Calif. 1923
HALL, ELGIN R. S., Orton, Ontario, Canada..... 1929
HALL, DR. F. GREGORY, Duke University, Durham, N. C.....Charter
HALL, FRANK S., 6320 17th Ave., N. E., Seattle, Wash.....Charter
HALL, NELSON E., Glacier National Park, Belton, Mont..... 1924
HAMILTON, WILLIAM J., JR., Dept. of Biology, Cornell University, Ithaca, N. Y..... 1924
HANAWALT, PROF. F. A., Orterbein College, Westerville, Ohio..... 1925
HAND, RALPH L., U. S. Forest Service, Avery, Idaho..... 1928
HANKINSON, THOMAS L., 96 Oakwood Ave., Ypsilanti, Mich.....Charter
HANSON, DR. KARL B., U. S. Experimental Fur Farm, Saratoga Springs, N. Y..... 1921
HARDISTY, ARTHUR H., 1426 Irving St., NE., Washington, D. C.....Charter

HARKIN, J. B., Commissioner of Dominion Parks, Dept. of Interior, Ottawa, Canada.....Charter
HARKINS, DANIEL J., Franklin Park Zoo, Grove Hall P. O., Boston, Mass... 1929
HARPER, DR. FRANCIS, 206 Dickinson Ave., Swarthmore, Pa.....Charter
HARRIS, COLEMAN J., Barboursville, W. Va..... 1925
HARRIS, HARRY, 5234 Hermosa Ave., Eagle Rock, Calif.....Charter
*HARRIS, WILLIAM P. JR., 15410 Windmill Point Drive, Grosse Pointe Park, Mich..... 1924
HARRISON, CARTER H. Jr., 215 S. Sheridan Rd., Lake Forest, Ill..... 1928
HARRISON, GEORGE L., 1520 Locust St., Philadelphia, Pa.....Charter
HART, CECIL, 132 N. Third St., Montebello, Calif..... 1925
HARTER, SAMUEL G., 3848 Third St., San Diego, Calif..... 1928
HARTMAN, PROF. CARL, Carnegie Laboratory of Embryology, Johns Hopkins Medical School, Baltimore, Md..... 1921
HARWELL, C. A., Yosemite Museum, Yosemite National Park, Calif..... 1927
HASKIN, JENNINGS N., Potomac Park Apt. 812, Washington, D. C..... 1926
HATT, DR. ROBERT T., American Museum Natural History, New York City..... 1921
HAVEN, HERBERT M. W., 500 Forest Avenue, Portland, Me.....Charter
HAWK, PROF. GROVER C., Penn College, Oskaloosa, Iowa..... 1923
HAWORTH, M. M. Alice, Maple Lane, Edgeworth, Sewickley, Pa..... 1927
HAY, DR. OLIVER P., U. S. National Museum, Washington, D. C..... 1921
HAYES, JOHN F., 7439 Paxton Ave., Chicago, Ill..... 1930
HECK, PROF. DR. LUDWIG, Budapesterstr. 9, Berlin W 62, Germany..... 1928
HEILER, VAN CAMPEN, Spring Lake Beach, N. J..... 1928
HELLER, EDMUND, Zoological Garden, Milwaukee, Wis.....Charter
HELLMAN, DR. MILO, 57 W. 57th St., New York City..... 1921
HELME, ARTHUR H., Miller Place, Suffolk County, N. Y.....Charter
HENDERSON, ARCHIBALD D., Belvedere, Alberta, Canada.....Charter
HENDERSON, JUNIUS, 1305 Euclid Ave., Boulder, Colo.....Charter
HENDERSON, WALTER C., 8 Magnolia Parkway, Chevy Chase, Md.....Charter
HENN, ARTHUR W., Carnegie Museum, Pittsburgh, Pa..... 1930
HERING, PAUL E., Dept. Biol., Rensselaer Poly. Inst., Troy, N. Y..... 1930
HERPICH, FRED C., Peabody Museum, New Haven, Conn..... 1930
HERRICK, HAROLD, 141 Broadway, New York City..... 1926
HIGBEE, HARRY G., Hill Top Haven, Sharon, Mass..... 1930
HILL, ALBERT E., 509 Valle Vista Ave., Oakland, Calif..... 1927
HILL, MRS. HOWARD G., 329 Summit Ave., Redlands, Calif..... 1926
HILL, JOHN E., 2115 Tenn. St., Lawrence, Kansas..... 1930
HILZHEIMER, DR. MAX, Wallstr. 52/54, Markisches Museum, Berlin, S-14, Germany..... 1925
HINE, PROF. JAMES S., Ohio State Museum, Ohio State Univ., Columbus, Ohio..... 1926
HINTON, MARTIN A. C., British Museum, London, England..... 1926
HISAW, PROF. FREDERICK L., Biology Bldg., Univ. of Wisconsin, Madison, Wis.....Charter
HIXON, GEORGE C., Field Museum of Natural History, Chicago, Ill..... 1930
HOBBS, KENNETH L., R. F. D., No. 1, Linden, Silver Spring, Md..... 1930

*Hodges, Charles, H., Jr., Grosse Pointe, Mich. 1927
*Hodges, Wetmore, Beverly Farms, Mass. 1927
Holland, Dr. W. J., Carnegie Museum, Pittsburgh, Pa. Charter
Hollister, Mrs. Mabel P., 1819 Ontario Place, N. W., Washington, D. C. 1925
Hollister, Warren D., Delavan, Wis. Charter
Holman, John P., Fairfield, Conn. 1921
Holt, Ernest G., c/o H. B. Leonard, 3951 44th St., Long Island City, N. Y. Charter
Holzworth, John M., 353 Westchester Ave., Port Chester, N. Y. 1924
Hopkins, A. D., Kenawha Farms, Mineral Wells, W. Va. 1926
Hornaday, Dr. Wm. T., 1 Bank St., Stamford, Conn. Charter
Horne, I. S., 505 Atlanta St., Altadena, Calif. 1923
Hörring, H., Mag. Scient., Zoologisk Museum, Copenhagen, Denmark 1924
Horsfall, R. Bruce, c/o American Nature Association, 1214 16th St., N. W., Washington, D. C. Charter
House, E. J., 55 Fidelity Bldg., Pittsburgh, Pa. 1926
Howard, John K., 55 Congress St., Boston, Mass. 1928
*Howell, A. Brazier, Dept. of Anatomy, Johns Hopkins Medical School, Baltimore, Md. Charter
Howell, Arthur H., 2919 South Dakota Avenue, Washington, D. C. Charter
Howland, Chester S., 425 Cottage St., New Bedford, Mass. 1928
Hoy, Dr. William E., Jr., Dept. Biol., Univ. of South Carolina, Columbia, S. C. 1922
Hubback, Theodore R., Sunlaws, Bukit Kota, Kuala Lipis, Pahang, Federated Malay States. 1922
Huber, Dr. Ernst, Dept. of Anatomy, Johns Hopkins Medical School, Baltimore, Md. 1922
Huber, Dr. G. Carl, 1330 Hill St., Ann Arbor, Mich. 1927
Huber, Wharton, Academy of Natural Sciences, Philadelphia, Pa. 1922
Huestis, R. R., Dept. of Zoology, Univ. of Oregon, Eugene, Ore. 1927
Huey, Laurence M., Museum of Natural History, Balboa Park, San Diego, Calif. Charter
Hughes, George T., Box 153, Plainfield, N. J. 1926
Hungate, Prof. J. W., State Normal School, Cheney, Wash. 1925
Hunt, Helen C., 51 Brattle St., Cambridge, Mass. 1928
Hyde, Benjamin T. B., 558 Camino del Monte Sol, Santa Fe, N. Mex. 1927
Ingebrigtsen, Lektor Olaf, Kathedralschule, Bergen, Norway 1925
Jackson, Prof. C. F., Dept. of Zoology, Univ. of New Hampshire, Durham, N. H. 1921
*Jackson, Dr. Hartley H. T., U. S. Biological Survey, Washington, D. C. Charter
Jackson, Mrs. Hartley H. T., 6313 Ridgewood Ave., Chevy Chase, Md. Charter
Jackson, Ralph W., Route No. 1, Cambridge, Md. 1921
Jacobi, Prof. Arnold, Museum fur Tierkunde, Dresden, Germany 1930
Jacobsen, William C., 1441 43rd St., Sacramento, Calif. Charter
Jacot, E. C., Box 462, Prescott, Ariz. 1921

JAEGER, EDMUND C., 1462 West 6th St., Riverside, Calif. 1921
JAMES, NORMAN, The James Lumber Company, Baltimore, Md. ..... Charter
JEPSON, GLENN L., Univ. Dept. Geol., Princeton, N. J. 1930
JEWETT, S. G., 582 Bidwell Ave., Portland, Oregon ..... Charter
JOHNSON, DR. ARTHUR M., Dept. of Biology, Univ. of California, Los Angeles, Calif. 1923
JOHNSON, PROF. CHARLES E., Dept. of Forest Zoology, State College of Forestry, Syracuse, N. Y. ..... Charter
JOHNSON, MISS ETHEL M., 2833 Myrtle Ave., N. E., Washington, D. C. 1926
JOHNSON, PROF. GEORGE E., Dept. of Zoology, State Agricultural College, Manhattan, Kansas ..... Charter
JOHNSON, JULIUS M., c/o Librarian, Haaren High School, 120 W. 46th St., New York City 1924
JOHNSON, M. S., Div. of Entomology, Univ. Farm, St. Paul, Minn. 1923
JOHNSON, DR. PAUL B., 3208 17th St., N. W., Washington, D. C. 1924
JONES, PROF. F. WOOD, Melbourne, Victoria, Australia 1921
JONES, GEORGE N., 1901 45th St., S. W., Seattle, Wash. 1927
JONES, ROBERT F., Longfellow Zoological Gardens, Minnehaha Falls, Minneapolis, Minn. ..... Charter
JONES, S. PAUL, 509 West Ave., North, Waukesha, Wis. 1929
JOSEPH, ELLIS S., 179 Mosholu Parkway, North, New York City 1923
JUNK, DR. W., Saechsischestr. 68, Berlin, W. 15, Germany 1930
KAIN, CONRAD, Wilmer, British Columbia 1923
KALMBACH, E. R., U. S. Biological Survey, Washington, D. C. 1925
KASHKAROV, DR. D., Novala 19, Usbekistan, U. S. S. R. 1929
KEAYS, J. E., 328 St. George St., London, Ontario 1924
KELLOGG, C. C., 269 S. Greenwood Ave., Pasadena, Calif. 1925
KELLOGG, DR. REMINGTON, U. S. National Museum, Washington, D. C. ..... Charter
KENG, LIM BOON, Univ. of Amoy, Amoy, China 1927
*KENNARD, FRED H., Dudley Road, Newton Center, Mass. 1922
KIDDER, Nathaniel T., Milton, Mass. 1921
KILHAM, LAWRENCE, 42 W. Cedar St., Boston, Mass. 1930
KING, DR. BENJAMIN H., 1215 Lake Shore Drive, Coeur d'Alene, Idaho 1922
KING, DR. HELEN D., 17 Elliot Ave., Bryn Mawr, Pa. 1930
*KIRKHAM, PROF. WILLIAM B., 275 Maple St., Springfield, Mass. ..... Charter
KIRKWOOD, FRANK C., Route No. 3, Monkton, Md. ..... Charter
*KIRN, ALBERT J. B., Box 157, Somerset, Texas 1922
KISTIN, ALBERT D., 162 E. Superior St., Chicago, Ill. 1930
KLOSS, C. BODEN, Raffles Museum, Singapore, Straits Settlements ..... Charter
KLUGH, A. BROOKER, Queens University, Kingston, Ontario, Canada ..... Charter
KNAPPEN, MISS PHOEBE, U. S. Biological Survey, Washington, D. C. 1928
KOMAREK, E. V., Chicago Acad. Sci., Chicago, Ill. 1928
KOOKER, T. H., Realty Bldg., Jacksonville, Florida 1925
KRAUSS, N. H., 2447 Parker St., Honolulu, T. H. 1929
KRAVIETZ, MARIE, 168 E. 66 St., New York City 1930
KURODA, DR. NAGAMICHI, Fukuyoshi Cho, Akasaka, Tokyo, Japan ..... Charter
*LADD, DR. WILLIAM S., 254th St. & Independence Ave., New York City. 1922

La Due, Harry, J., St. Peter, Minn. 1927
Landberg, Robert L., 4672 Sherman St., Denver, Colo. 1927
Lane, Dr. H. H., Dept. Zoology, University of Kansas, Lawrence, Kansas. Charter
Lane, H. Wallace, Dyche Museum, Lawrence, Kansas. 1930
*Lang, Herbert, American Museum of Natural History, New York City. Charter
Langstroth, James H., P. O. Bin D, Silver City, N. Mex. 1926
Langworthy, Dr. O. R., Dept. of Neurology, Johns Hopkins Hospital, Baltimore, Md. 1928
Larrabee, Prof. Austin P., Yankton College, Yankton, S. D. 1921
La Voy, Merl, Explorers Club, New York City. 1930
Lawton, Benjamin, Game Commissioner, Edmonton, Alberta, Can. 1929
Lee, Henry E., Box 495, Rapid City, S. D. 1925
Leffler, Ross L., 502 Coursin St., McKeesport, Pa. 1928
*Leighton, Alexander H., 11 Alexander St., Princeton, N. J. 1924
Leister, C. W. N. Y. Zoological Park, New York City. Charter
Leopold, Aldo, 421 Chemistry Bldg., Madison, Wis. Charter
Letl, Frank H., Field Museum Natural History, Chicago, Ill. 1927
Lewis, John B., P. O. Box 86, Amelia, Va. 1926
Lewis, Merriam G., Lexington, Va. 1926
Lewis, Dr. Nolan D. C., St. Elizabeths Hospital, Washington, D. C. 1927
Ligon, J. Stokley, Box 928, Carlsbad, N. Mex. Charter
Lincoln, Frederick C., U. S. Biological Survey, Washington, D. C. Charter
Lindgren, Dr. Homer D., New York Univ., New York City. 1927
Linsdale, Dr. Jean, Museum of Vertebrate Zoology, Berkeley, Calif. 1921
Lippold, Benjamin F., 15 Park Row, New York City. 1927
Little, Dr. Clarence C., Bar Harbor, Me. 1927
Little, Luther, 1400 Wayne Ave., South Pasadena, Calif. Charter
Lloyd, Hoyes, 582 Mariposa Avenue, Rockliffe Park, Ottawa, Can. Charter
Locke, S. B., Forest Service, Ogden, Utah. 1923
Long, William H., 1612 Morton Ave., Box 375, Ann Arbor, Mich. 1929
Longman, Heber A., Queensland Museum, Brisbane, Queensland, Australia. 1925
Lönnberg, Dr. Einar, Naturhistoriska Riksmuseum, Vetenskapsakademien, Stockholm, 50, Sweden. Charter
Loomis, Prof. F. B., 8 Orchard St., Amherst, Mass. 1926
Loomis, Lee J., 202 E. Union St., Union, N. Y. 1927
Loring, J. Alden, Owego, Tioga County, N. Y. Charter
Lowe, Prof. John N., Normal College, Marquette, Mich. 1925
Lyman, Storrs H., 901 S. 3rd St., Dayton, Wash. Charter
*Lyman, Prof. Theodore, Jefferson Physical Laboratory, Harvard Univ., Cambridge, Mass. 1921
*Lyon, Dr. M. W., 122 N. Lafayette Boulevard, South Bend, Ind. Charter
Lyon, William I., 811 N. Sheridan Road, Waukegan, Ill. 1925
MacAleer, Miss Genevieve, 68 Post St., San Francisco, Calif. 1929
MacCoy, Clinton V., 1213 Beacon St., Brookline, Mass. 1930
Macko, Harry A., 935 Meadow Ave., Charleroi, Pa. 1923

MACNAMARA, CHARLES, Arnprior, Ontario, Canada..... 1927
MADISON, HAROLD L., Cleveland Museum of Natural History, Cleveland, Ohio.....Charter
MAGEE, M. J., 603 South St., Sault Ste. Marie, Mich..... 1925
MAILLIARD, JOSEPH, 1815 Vallejo St., San Francisco, Calif.....Charter
MALLINCKRODT, EDWARD, JR., 16 Westmoreland Place, Saint Louis, Mo.. . 1922
*MANN, DR. WM. M., National Zoological Park, Washington, D. C..... 1926
MANNHARDT, PROF. L. ALFRED, 55 Rock Lane, Berkeley, Calif..... 1924
MANNING, JOHN S., 211 N. Lexington Ave., Pittsburgh, Pa..... 1926
MARCOTTE, L'ABBE LEON, Seminaire St. Charles, Sherbrooke, Quebec, Canada..... 1925
MARDEN, AARON, Eagle Island, South Harpswell, Me..... 1926
MARLAND, ERNEST W., P. O. Box 1286, Ponca City, Okla..... 1927
MARSHALL, DR. E. KENNERLY, JR., Johns Hopkins Medical School, Baltimore, Md..... 1927
MARSHALL, FLORENCE G., 525 West End Ave., New York, N. Y..... 1930
MARTINO, VALDIMIR E., Majdanska 56, Topcider near Belgrad, Jugoslavia..... 1929
*MATTHEW, DR. WM. D., Dept. of Paleontology, Univ. of California, Berkeley, Calif.....Charter
MATTHEWS, FRANK P., 160 Kent St., Brookline, Mass..... 1928
MCBLAIN, WALTER G., JR., U. S. Fur Animal Experiment Station, Saratoga, N. Y..... 1930
MCCABE, THOMAS T., Barkerville, B. C., Can..... 1928
MCCAMPBELL, SAM C., Zoological Department, State Agricultural College, Fort Collins, Colo..... 1924
MCCLINTOCK, NORMAN, 504 Amberson Avenue, Pittsburgh, Pa.....Charter
MCCOY, HOMER, 5453 44th Ave., S., Minneapolis, Minn..... 1930
MCCRACKEN, HAROLD, Field & Stream, 578 Madison Ave., New York City..... 1928
MCGREGOR, PROF. JAMES H., Columbia Univ., New York City..... 1927
MCGUIRE, J. A., Editor, Outdoor Life, Denver, Colo.....Charter
MCILHENNY, EDWARD A., Avery Island, La.....Charter
MCKECHNIE, DR. WILLIAM C., 751 Granville St., Vancouver, B. C..... 1927
MCLAIN, ROBERT B., P. O. B. 132, Hollywood Station, Los Angeles, Calif.....Charter
MCNAIR, GEORGE T., Dept. of Zoology, Univ. of Kansas, Lawrence, Kansas..... 1929
MEDSGER, OLIVER P., 9 Columbia Avenue, Arlington, N. J..... 1920
MEISNEST, FREDERICK H., Atlantic Coast Fisheries Co., 111 John St., New York City..... 1928
MERRIAM, DR. JOHN C., Carnegie Institution of Washington, Washington, D. C.....Charter
MERRIAM, LYMAN L., 10 Emwilton Pl., Ossining, N. Y..... 1925
MERSHON, WM. B., Saginaw, Mich..... 1925
MESSER, HAROLD M., 6 Adele Place, Baldwin, N. Y..... 1926
METCALF, PROF. Z. P., North Carolina State College, Raleigh, N. C...Charter
MIDDLETON, DR. AUSTIN R., Biological Laboratories, Univ. of Louisville, Louisville, Ky..... 1921

MILLER, DR. ALDEN H., Museum of Vertebrate Zoology, Berkeley, Calif.. 1930
MILLER, ERNEST, Bozeman, Mont..... 1929
MILLER, FREDERIC W., 935 S. Gaylord St., Denver, Colo..... 1921
MILLER, GERRIT S. JR., U. S. National Museum, Washington, D. C....Charter
MILLER, DR. LOYE H., Univ. of California, Los Angeles, Calif.....Charter
MILLER, DR. ROBERT C., Univ. of Washington, Seattle, Wash..... 1925
MILLER, PROF. SHIRLEY P., Institute of Anatomy, Univ. of Minnesota, Minneapolis, Minn.....Charter
MILLER, W. B., U. S. Biological Survey, Nome, Alaska..... 1928
MILLS, DAVID C., 242 W. 30th St., New York City..... 1926
MILLS, ERNEST M., Fernald Hall, M. A. C., Amherst, Mass..... 1927
MIRGUET, JOSEPH C., 449 Magnolia St., Rochester, N. Y..... 1928
MITCHELL, C. C., c/o Bates Mfg. Co., Joliet, Ill..... 1928
MOFFITT, JAMES, 1879 Broadway, San Francisco, Calif..... 1929
MOHR, CARL, Dept. of Entomology, Univ. of Illinois, Urbana, Ill..... 1927
MOHR, ERNA W., Zoologische Museum, Hamburg, Germany..... 1928
MOODY, PAUL A., Dept. of Zoology, Williams Science Hall, Burlington, Vt..... 1923
MOONEY, JAMES T., Ridge Road, R. F. D., No. 1, Deerfield, Ill..... 1930
MOORE, A. W., 1671 Main St., Hillsboro, Ore..... 1921
MOORE, ROBERT D., 744 Walnut Ave., Redlands, Calif..... 1929
MOORE, ROBERT T., 1420 E. Mountain St., Pasadena, Calif..... 1926
MORDEN, WM. J., American Museum Natural History, New York City... 1925
MORI, TAMEZO, Preparatory Dept., Keijo Imperial Univ., Seoul, Chosen... 1927
MORRIS, WILLIAM E. 908 Thatuna St., Pullman, Wash..... 1927
MORTON, DR. DUDLEY J., 169 Cold Spring St., New Haven, Conn..... 1926
MOSELEY, PROF. E. L., State College, Bowling Green, Ohio.....Charter
MOSSMAN, DR. HARLAND W., 1707 Jefferson St., Madison, Wis..... 1930
MOUNTS, MRS. BERYL T., Ballard Normal School, Macon, Ga..... 1926
MOYER, JOHN W., Field Museum of Natural History, Chicago, Ill..... 1930
MUMA, ROBERT J., Ilderton, Ontario, Canada..... 1927
MUNROE, RALPH M., Cocoanut Grove, Fla..... 1922
MURIE, ADOLPH, Univ. Museums, Ann Arbor, Mich..... 1924
MURIE, O. J., Jackson, Wyo.....Charter
MURRAY, T. B., P. O. Box 13, Boise, Idaho..... 1927
NAUMBURG, MRS. WALTER H., Davis Farm, New Canaan, Conn..... 1922
NELSON, THEODORE, Hunter College, 66 Court St., Brooklyn, N. Y..... 1929
NEWBEGIN, EDWARD K., 62 Sparks St., Cambridge, Mass..... 1926
NEWBY, W. W., Dept. of Zool., Univ. of Utah, Salt Lake City, Utah..... 1926
NEWSOM, WILLIAM M., 228 E. 61st St., New York City..... 1926
NICHOLS, JOHN T., American Museum of Natural History, New York City.....Charter
NOBACK, CHARLES V., New York Zoological Society, Bronx, N. Y..... 1929
NOBLE, DR. G. K., American Museum of Natural History, New York City..... 1926
NOBLE, HOWARD, 101 Tremont St., Boston, Mass..... 1930
NORTON, ARTHUR H., Museum of Natural History, Portland, Me.....Charter
OBERHOLSER, DR. HARRY C., 2805 18th St. N. W., Washington, D. C.....Charter

OBOLENSKY, S. I., Station for Plant Protection, Tshajnovskago, F., Leningrad, U. S. S. R. 1927
ODERKIRK, GALEN C., Dept. of Entomology, Purdue Univ., Lafayette, Ind. 1927
O'DONOGHUE, PROF. CHAS. H., Dept. of Zoology, Univ. of Edinburgh, Edinburgh, Scotland ..... Charter
OEHSER, PAUL H., U. S. Biological Survey, Washington, D. C. 1926
OGDEN, DR. H. V., 436 Summit Ave., Milwaukee, Wis. ..... Charter
OGNEV, DR. S. T., Univ. Zoological Museum, Moscow, U. S. S. R. 1924
OKKELBERG, PROF. PETER, 1116 Ferndon Road, Ann Arbor, Mich. ..... Charter
OLIVER, W. R. B., Dominion Museum, Wellington, New Zealand 1924
OSBORN, CHASE S., 601 Adams Bldg., Sault Ste. Marie, Mich. 1925
OSBORN, WILLIAM P., 48 Benedict Ave., Tarrytown, N. Y. 1927
*OSGOOD, DR. WILFRED H., Field Museum of Natural History, Chicago, Ill. ..... Charter
OVER, WILLIAM H., Univ. of South Dakota, Vermillion, S. D. 1924
PACK, ARTHUR N., 11 Morven St., Princeton, N. J. 1929
PALMER, DR. E. LAURENCE, Fernow Hall, Ithaca, N. Y. 1927
PALMER, L. J., Reindeer Experiment Station, College, Alaska 1927
PALMER, DR. T. S., 1939 Biltmore Street, N. W., Washington, D. C. ..... Charter
PARCHER, FRANK M., Independence, Calif. 1928
PARKER, DR. GEORGE H., 16 Berkeley St., Cambridge, Mass. ..... Charter
PARKER, HARRY C., Museum of Natural History, Lawrence, Kansas 1927
PARKER, WESLEY D., Sullys Hill Natl. Preserve, Ft. Totten, N. Dak. 1926
PARRISH, MORRIS L., Dormy House, Clementon, N. J. 1921
PARTELLO, COL. J. M. T., 3248 Washington St., San Francisco, Calif. 1925
PATTERSON, BRYAN, Field Museum of Natural History, Chicago, Ill. 1929
PAYNE, EUGENE H., Marquette Univ. School of Medicine, Milwaukee, Wis. 1925
PEARSE, DR. A. S., Duke University, Durham, N. C. 1927
PEARSON, T. GILBERT, 1974 Broadway, New York City ..... Charter
PELLEW, MISS MARIAN I., Box 455, Aiken, S. C. 1926
PENNOCK, CHARLES J., Kennett Square, Pa. 1921
PERKINS, PROF. E. H., Box 52, Colby College, Waterville, Me. 1922
PERKINS, IRVING J., Public Museum, Milwaukee, Wis. 1928
PERKINS, JAMES H., Box 205, Greenwich, Conn. 1927
PERRYGO, WATSON M., U. S. National Museum, Washington, D. C. 1926
PERSING, ELLIS C., Cleveland School of Education, Cleveland, Ohio. 1927
PERSONS, GLENN W., Box 1212, Bisbee, Ariz. 1930
PETERS, JAMES L., Lane End, Harvard, Mass. ..... Charter
PHELPS, FRANK M., 128 Cedar St., Elyria, Ohio 1926
PHILLIPS, FRANK, F. P. Ranch, Route 4, Bartlesville, Okla. 1926
*PHILLIPS, DR. JOHN C., Wenham, Mass. ..... Charter
PHILLIPS, JOHN M., 2227 Jane St., Pittsburgh, Pa. ..... Charter
PHILLIPS, MAURICE E., Henshaw Road, Route 1, Ithaca, N. Y. 1928
PICKENS, A. L., 202 Grove St., Greenville, S. C. 1926
PICKWELL, GAYLE B., State Teachers College, San Jose, Calif. 1926
PIERCE, WRIGHT M., Box 343, Claremont, Calif. 1926

PIERSON, PROF. CHARLES J., College Park, Md.....Charter
PIRNIE, MILES D., Dept. of Conservation, Lansing, Mich..... 1928
PITCHER, MRS. ISABEL V. S., Route 3, Box 384, Hayward, Calif..... 1926
POHLE, DR. HERMANN, Zoologisches Museum der Universitat, Invalidenstrasse 43, Berlin, N. 4, Germany..... 1928
POMEROY, DANIEL E., 30 Church St., New York City..... 1928
POOLE, ARTHUR J., Room 51, U. S. National Museum, Washington, D. C.....Charter
POOLE, E. L., Reading Public Museum, Reading, Pa..... 1922
POPE, DR. ALTON S., 92 Central Ave., Newtonville, Mass.....Charter
POPE, CLIFFORD H., American Museum of Natural History, New York City..... 1924
*POPE, GUSTAVUS D., 1020 Ford Bldg., Detroit, Mich..... 1924
POUGH, RICHARD H., 4 Lenox Place, St. Louis, Mo..... 1927
POWERS, DR. LILLIAN D., Red Squirrel Farm, White Plains, N. Y.....Charter
POWERS, PHIL B., Biology Dept., Rice Inst., Houston, Texas..... 1929
*PRATT, HON. GEORGE D., 26 Broadway, New York City.....Charter
PREBLE, EDWARD A., U. S., Biological Survey, Washington, D. C.....Charter
PREENE, FRANK H. E., 3045 Villa Ave., New York City..... 1927
PRICE, DR. EMMETT W., 3718 R. St. N. W., Washington, D. C..... 1930
PRINGLE, MISS CORNELIA C., 1816 Vallejo St., San Francisco, Calif..... 1926
PRITCHARD, NORMAN H., 120 S. La Salle St., Chicago, Ill..... 1930
RACEY, KENNETH, 3262 First Ave., Vancouver, B. C..... 1925
RADOSAVLJEVICH, PAUL R., New York Univ., New York City..... 1927
RAMSDEN, DR. CHARLES T., P. O. Box 146, Guantanamo, Cuba.....Charter
RAVEN, HARRY C., American Museum of Natural History, New York City.....Charter
RAYNES, GEORGE W., 209 Miller Ave., Portsmouth, N. H..... 1922
REDINGTON, PAUL G., U. S. Biological Survey, Washington, D. C..... 1929
REED, ERVIN E., Monticello, Iowa..... 1925
REED, MEREDITH P., 216 N 3rd St., Vincennes, Ind..... 1927
REEDER, GEORGE K., 206 Walker Bank Bldg., Salt Lake City, Utah..... 1929
REEVES, MARK W., Stockade, Clinton, Conn..... 1928
REHN, JAMES A. G., Academy of Natural Sciences, Philadelphia, Pa...Charter
REID, RUSSELL, 210 Thayer St., Bismarck, N. D.....Charter
RICH, DR. GUY C., 1820 El Cerrito Place, Hollywood, Calif..... 1922
RICHMOND, DR. CHAS. W., U. S. National Museum, Washington, D. C. Charter
RICHTER, DR. Curt P., Psychological Laboratory, Johns Hopkins Hospital, Baltimore, Md..... 1924
RIDGWAY, JOHN L., 501 Fairmont St., Glendale, Los Angeles, Calif..... 1926
RIDSDALE, P. S., 1214-16th St., N. W., Washington, D. C..... 1926
RIEMER, JULIUS, Berlinerstr. 163, Berlin-Tempelhof, Germany..... 1930
RIIS, PAUL B., Broughton, Pa..... 1926
RILEY, J. H., U. S. National Museum, Washington, D. C.....Charter
*RINDSFOOS, WILLIAM, Brunson Bldg., Columbus, Ohio.....Charter
RITTER, DR. WM. E., Dept. of Biology, Univ. of Calif., Berkeley, Calif... 1926
ROBB, WALLACE H., Abbey Dawn, R. R. 1, Kingston, Ontario, Canada... 1925
ROBERTS, HOWARD R., Villa Nova, Pa..... 1925

ROBERTS, DR. T. S., Zoological Museum, Univ. of Minnesota, Minneapolis, Minn.....Charter
ROBERTSON, HOWARD, 157 Wilton Drive, Los Angeles, Calif.....Charter
ROBERTSON, PROF. W. R. B., K. S. A. C., Manhattan, Kansas..... 1922
ROBINSON, JAMES B., Quarters B, Navy Yard, Bremerton, Wash..... 1923
ROBINSON, HON. T. DOUGLAS, Mohawk, N. Y..... 1924
RODOCK, ROY E., Lewiston State Normal School, Lewiston, Idaho..... 1928
ROFF, WM. W., 1741 Calumet Ave., Detroit, Mich..... 1930
ROGERS, ALBERT C., Colorado Museum of Natural History, Denver, Colo.....Charter
*ROGERS, CHAS. H., Museum of Zoology, Princeton, N. J.....Charter
ROGERS, WALLACE, 173 Hurt St., N. E., Atlanta, Ga..... 1926
ROIGNEAU, MARCELLE, American Museum of Natural History, New York City..... 1927
ROMELL, LARS G., College of Agriculture, Ithaca, N. Y..... 1930
ROOSEVELT, KERMIT, 11 Broadway, New York City.....Charter
ROOSEVELT, THEODORE, JR., Oyster Bay, Long Island, N. Y..... 1925
ROPSHAW, DR, H. J., 1291 E. Boulevard, Cleveland, Ohio.....1923
ROSE, FRANK H., National Bison Range, Moiese, Mont..... 1928
ROSS, ETTA L., 1820 Bushnell Ave., South Pasadena, Calif..... 1927
ROSS, ROLAND C., 1820 Bushnell St., South Pasadena, Calif..... 1925
ROTHROCK, BOYD P., Pennsylvania State Museum, Harrisburg, Pa.....Charter
*ROTHSCHILD, LORD LIONEL WALTER, Zoological Museum, Tring, Herts, England.....Charter
ROWAN, PROF. WILLIAM, University of Alberta, Edmonton, Alberta, Can..... 1921
ROWLEY, JOHN S., 403 S. First St., Alhambra, Calif..... 1928
RUHE, HERMANN, Kalandstr., Alfeld/Leine, Germany..... 1930
RUHL, H. D., Michigan State College, East Lansing, Mich..... 1928
RUSH, W. M., Yellowstone Park, Wyo..... 1925
RUSSELL, LORIS S., Dept. of Geology, Princeton Univ., Princeton, N. J.. 1929
RUSSELL, WARD C., Route 2, Box 13, Santa Cruz, Calif..... 1930
RUST, HENRY J., Box 683, Coeur d'Alene, Idaho..... 1922
SAGE, DEWITT, 580 Park Ave., New York City..... 1928
SAMPSON, W. B., 1005 N. San Joaquin St., Stockton, Calif..... 1924
SAMPSON, W. F., Matson Bldg., 215 Market St., San Francisco, Calif..... 1927
SANBORN, COLIN C., Field Museum of Natural History, Chicago, Ill..... 1924
SANDERSON, WILFRED E., 80 Howard St., Albany, N. Y..... 1927
SANS, EDWARD R., Box 805, Reno, Nev.....Charter
SANTENS, JOSEPH A., American Museum of Natural History, New York City..... 1921
SANTENS, R. H., Carnegie Museum, Pittsburgh, Pa..... 1925
SASS, HERBERT R., 23 Legare St., Charleston, S. C..... 1928
SAUNDERS, ARETAS A., 48 Longview Ave., Fairfield, Conn.....Charter
SAUNDERS, W. E., London, Ontario, Can.....Charter
SAVAGE, JAMES, 1048 Ellicott Square, Buffalo, N. Y..... 1925
SAVIN, WILLIAM M., 52 Broadway, New York City..... 1925
SCALON, W. W., c/o Madame Sofie N. Scalon, Troudowaja 6, Nowosibirsk, U. S. S. R..... 1927

SCHEAR, PROF. E. W. E., 107 West Park St., Westerville, Ohio..... 1922
SCHEFFER, THEODORE H., Puyallup, Wash.....Charter
SCHIERBECK, OTTO, Chief Forester, Dept. of Lands & Forests, Halifax, N. S..... 1928
SCHMIDT, F. J. W., Stanley, Wis..... 1927
SCHMIDT, KARL P., Field Museum of Natural History, Chicago, Ill..... 1925
SCHMIDTT, DR. WALDO L., U. S. National Museum, Washington, D. C. Charter
SCHOONMAKER, WALTER J., State Museum, Albany, N. Y..... 1924
SCHORGER, A. W., 2021 Kendall Ave., Madison, Wis..... 1924
SCHROEDER, EDWARD, 811 S. 16th St., Manitowoc, Wis..... 1928
SCHULTE, PROF. HERMANN VON W., Creighton Univ. College of Medicine, Omaha, Neb.....Charter
SCHULTZ, DR. ADOLPH H., Dept. of Anatomy, Johns Hopkins Medical School, Baltimore, Md.....Charter
SCHULTZ, EDITH C., 460 W. 147th St., New York City 1930
SCHURR, BURLINGTON, Naturalist on the Mountain, Granby, Mass..... 1929
SCHWARZ, DR. ERNST, Zoologisches Museum, Invalidenstr. 43, Berlin, N. 4, Germany..... 1925
SCHWIDETZKY, GEORG, Mittelstr. 4, Leipzig, Germany..... 1930
SCOTT, PROF. JOHN W., Univ. of Wyoming, Laramie, Wyo..... 1925
SEFTON, JOSEPH W., JR., 638 F. St., San Diego, Calif..... 1925
SELLE, RAYMOND M., Occidental College, Los Angeles, Calif..... 1928
*SETON, ERNEST-THOMPSON, Greenwich, Conn.....Charter
SETON, HENRY, 77 Martin St., Cambridge, Mass..... 1924
SHADLE, PROF. ALBERT R., Univ. of Buffalo, Buffalo, N. Y..... 1925
SHAMEL, H. HAROLD, U. S. National Museum, Washington, D. C..... 1923
SHAW, TSEN-HWANG, Biological Laboratory, Tsing Hua College, Peking, China..... 1928
SHAW, WILLIAM T., 1002 Cambridge Ave., Fresno, Calif.....Charter
SHEAK, W. H., 154 N. 21st St., Philadelphia, Pa..... 1921
SHEARER, DR. AMON R., Mont Belvieu, Chambers Co., Texas..... 1923
SHELDON, CAROLYN, Milton, Mass..... 1930
SHELDON, HARRY H., 616 E. Victoria St., Santa Barbara, Calif..... 1925
SHELDON, H. P., U. S. Biological Survey, Washington, D. C..... 1928
SHELFORD, DR. VICTOR E., Vivarium Bldg., Champaign, Ill..... 1923
SHELTON, AGEE, 627 N. Michigan Ave., Glendora, Calif..... 1928
SHEPPARD, WALTER B., 1060 Gaylord St., Denver, Colo..... 1929
*SHERMAN, MISS ALTHEA R., National, via McGregor, Iowa.....Charter
SHERMAN, HARLEY B., Box 2071, Univ. Sta. P. O., Gainesville, Fla.....Charter
*SHIRAS, Hon. George 3rd, 4530 Klingle St., N. W., Washington, D. C..Charter
SHOEMAKER, CLARENCE R., U. S. National Museum, Washington, D. C.....Charter
SHOEMAKER, CAPT. HENRY W., American Legation, Sofia, Bulgaria....Charter
SIGL, ALPHONSE J., 35 Alameda St., Rochester, N. Y..... 1928
SILLIMAN, O. P., Cor. Alisal & Riker Sts., Salinas, Calif..... 1924
SILVER, JAMES, U. S. Biological Survey, Washington, D. C.....Charter
SIMMONS, GEO. F., Cleveland, Ohio..... 1921

SIMPSON, DR. GEO. G., American Museum of Natural History, New York City..... 1928
SINCLAIR, DR. W. J., 154 Prospect Ave., Princeton, N. J..... 1923
SIRMAN, G. F., P. O. Box 4073, Sta. A, Miami, Fla..... 1928
SKELDON, FRANK L., 1117 Shadow Lawn Drive, Toledo, Ohio..... 1929
SKINNER, M. P., Jergins Trust Bldg., Long Beach, Calif.....Charter
SLAUTTERBACK, JOHN J., State Game Commission, Harrisburg, Pa..... 1926
SLEGGS, GEORGE F., Memorial Univ. College, St. John's, Newfoundland.. 1926
SMITH, AUSTIN P., Apartado 412, San Jose, Costa Rica.....Charter
SMITH, HORACE G., 2918 Lafayette St., Denver, Colo.....Charter
SMITH, LAWRENCE D., Lake Forrest, Ill..... 1928
SMITH, MISS VERA G., Biology Dept., Oklahoma College for Women, Chickasha, Okla..... 1923
SMITH, WENDELL P., Wells River, Vt..... 1927
SMITH, DR. WILBUR K., Dept. of Anatomy, Johns Hopkins Medical School, Baltimore, Md..... 1929
SNYDER, HARRY, 35 E. Wacker Drive, Chicago, Ill..... 1925
SNYDER, L. L., Royal Ontario Museum of Zoology, Toronto, Ontario..... 1921
SNYDER, MRS. VIOLA S., 4702 Hunt Ave., Chevy Chase, Md.....Charter
SOPER, J. DEWEY, N. W. Territory & Yukon Branch, Dept. of Interior, Ottawa, Can.....Charter
SOUDEK, DR. STEPAN, Zoological Institut, College of Agric. & Forestry, Brno, Czechoslovakia..... 1926
SOWERBY, ARTHUR DEC., c/o Hongkong & Shanghai Bank, Shanghai, China.....Charter
SPALDING, IRWIN, P. O. Box 2787, Honolulu, T. H..... 1928
SPAULDING, PROF. M. HERRICK, 507 S. 8th Ave., Bozeman, Mont.....Charter
SPENCER, DONALD A., 204 Aztec Bldg., San Antonio, Texas..... 1928
SPERRY, ARTHUR B., Kansas Agricultural College, Manhattan, Kansas... 1923
SPERRY, CHARLES C., U. S. Biological Survey, Washington, D. C.....Charter
SPRAGUE, ISSAC, Wellesley Hills, Mass..... 1926
STARK, W. P., 1789 Rockland Ave., Victoria, British Columbia.....Charter
STEENBERG, DR. CARL M., Silene Alle 9, Copenhagen-Sorberg, Denmark. 1929
STEFANSSON, VILHJALMUR, 27 W. 44th St., New York City.....Charter
STEGEMAN, LEROY C., N. Y. State College of Forestry, Syracuse, N. Y.. 1929
STEIN, CHARLES F., JR., 231 St. Paul St., Baltimore, Md..... 1926
STEPHENS, FRANK, 3746 Park Boulevard, San Diego, Calif.....Charter
STEVENS, ROSS O., 604 E. Madison St., Ann Arbor, Mich..... 1920
STEWART, PHILLIP B., Hotel El Encanto, Santa Barbara, Calif..... 1921
STICHEL, DR. W., Zentralstrasse 3, II, Leipzig, Germany..... 1929
STILES, DR. C. W., Hygienic Laboratory, 25th & E Sts., N. W., Washington, D. C..... 1928
STIRTON, R. A., Museum of Paleontology, Berkeley, Calif..... 1923
STOCK, DR. CHESTER, Calif. Inst. of Technology, Pasadena, Calif.....Charter
STOCKARD, A. H., Zoological Laboratory, Univ. of Michigan, Ann Arbor, Mich..... 1928
STODDARD, HERBERT L., U. S. Biological Survey, Washington, D. C... Charter
STONE, DWIGHT D., Route 1, Casa Grande, Ariz.....Charter

STONE, HARRY H., P. O. Box 101, Sturbridge, Mass..... 1926
STONE, ROBERT G., 575 Boylston St., Brookline, Mass..... 1926
STONE, DR. WITMER, Academy of Natural Sciences, Philadelphia, Pa..Charter
STONER, PROF. DAYTON, 70, U. S. Entomological Laboratory, Sanford, Fla.....Charter
STORER, DR. TRACY I., Division of Zoology, University Farm, Davis, Calif.....Charter
STOVELL, HORACE P., Royal Ontario Museum of Zoology, Toronto, Can.. 1929
STRAUS, DR. WILLIAM, L. JR., Dept. of Anatomy, Johns Hopkins Medical School, Baltimore, Md..... 1925
STRAY, JOSEPH W., 84 Broadway, Brooklyn, N. Y..... 1924
STREATOR, CLARK P., 16 Mason St., Santa Cruz, Calif.....Charter
STRECKER, PROF. JOHN K., Baylor Univ., Waco, Texas..... 1925
STREETER, CAPT. D. D., 214 Fenimore St., Brooklyn, N. Y.....Charter
STRUNK, W. L., Luther College, Decorah, Iowa..... 1929
STRUTHERS, PROF. PARKE H., Dept. of Zoology, Syracuse Univ., Syracuse, N. Y..... 1922
STUART, EDWARD T., JR., 2133 St. James Pl., Philadelphia, Pa..... 1926
STURTEVANT, MAJ. C. G., 4708 Abbott Ave., Dallas, Texas..... 1923
SUMNER, E. L. JR., Museum of Vertebrate Zoology, Berkeley, Calif..... 1926
SUMNER, DR. FRANCIS B., Scripps Institution, La Jolla, Calif.....Charter
SURBER, THADDEUS, 1539 Dayton Ave., St. Paul, Minn..... 1925
SUTTON, GEORGE M., Pebble Hearths, Bethany, W. Va..... 1925
SVIHLA, ARTHUR, Dept. Zoology, State College of Washington, Pullman, Washington..... 1926
SVIHLA, MRS. RUTH D., Dept. Zoology, State College of Washington, Pullman, Washington..... 1927
SWARTH, HARRY S., Calif. Academy of Sciences, San Francisco, Calif..Charter
SWENK, PROF. MYRON H., 1410 North 37th St., Lincoln, Nebraska.....Charter
SWINDLE, DR. PERCY F., 189 Lloyd St., Milwaukee, Wis..... 1927
TABER, WILLIAM B., JR., Greenwood Farm, Kansas, Ill..... 1926
TANNER, PROF. VASCO M., Brigham Young Univ., Provo, Utah.....Charter
TATE, GEORGE H. H., Boehm Ave., Tabor, N. J..... 1924
TAYLOR, DR. EDWARD H., Dept. of Zoology, Univ. of Kansas, Lawrence, Kansas..... 1924
TAYLOR, DR. H. N., 111 W. Adams St., Jacksonville, Fla..... 1925
TAYLOR, DR. WALTER P., 1746 East 5th St., Tucson, Arizona.....Charter
TEACHENOR, DIX, K. C. Life Insurance Co., Amour & Broadway, Kansas City, Mo..... 1920
TENNEY, EDWARD V., 661 Clinton Ave., Fresno, Calif..... 1929
TENNEY, DR. H. K., JR., 2110 Chadbourne Ave., Madison, Wis..... 1927
TERHUNE, HUGH W., Box DD, Juneau, Alaska..... 1928
TEST, FREDERICK H., 511 Russell St., West Lafayette, Ind..... 1930
*THAYER, JOHN E., George Hill Road, Lancaster, Mass.....Charter
THOMPSON, HARTLEY, Westmoreland, N. Y..... 1921
THORPE, DR. MALCOLM R., Yale Univ. Museum, New Haven, Conn..... 1921
TINKLEPAUGH, OTTO L., Institute of Psychology, Yale Univ., New Haven, Conn..... 1928

TODD, DR. T. WINGATE, Western Reserve Medical School, Cleveland, Ohio.....Charter
TOMKINS, IVAN R., U. S. Dredge "Morgan," Savannah, Ga..... 1930
TOUT, WILSON, North Platte, Neb..... 1926
TOWNSEND, PROF. M. T., Illinois Wesleyan Univ., Bloomington, Ill..... 1928
TRAPIER, PAUL E., 7020 Spad Place, Culver City, Calif..... 1929
TRESCOT, E. B., Route 4, Box 357, Petaluma, Calif.....Charter
TREXLER, HARRY C., 1205 P. P. & L. Bldg., Allentown, Pa..... 1921
TROST, HENRY J., DeYoung Memorial Museum, San Francisco, Calif..... 1926
TRUDEL, PAUL J., 479 Delaware Ave., Buffalo, N. Y..... 1928
TUROV, PROF. S., Gorsk. Pedagog. Inst., Markusstr. 20, Wladikavkas, U. S. S. R..... 1930
TYRRELL, W. BRYANT, Cranbrook Museum, Bloomfield Hills, Mich..... 1929
UHLER, FRANCIS M., U. S. Biological Survey, Washington, D. C..... 1926
UIHLEIN, JOSEPH E., 930 Lake Drive, Milwaukee, Wis.....Charter
ULRICH, W. C., 969 Woodland Ave., Plainfield, N. J..... 1927
VANCE, R. B., Allendale, S. C..... 1927
VAN DEINSE, A. B., Rochussenstraat 191 A, Rotterdam, Holland..... 1929
VAN DEN BRINK, F. H., 19 Dillenburgstraat, Utrecht, Holland..... 1928
VAN GELDER, G., Drift 12, Blaricum, Holland..... 1928
VAN HYNING, T., Florida State Museum, Gainesville, Fla.....Charter
VAN TYNE, DR. JOSSELYN, Univ. Museums, Ann Arbor, Mich..... 1924
VERNAY, ARTHUR S., 51 Berkeley Square, London, England..... 1928
VERSLUYS, DR. JAN, Grinzingerallee 18, Vienna, Austria..... 1930
VON BLOEKER, JACK C., Route I, Box 295c, Gardena, Calif..... 1927
VORHIES, DR. CHARLES T., Univ. of Arizona, Tucson, Arizona.....Charter
VREELAND, FREDERICK K., 90 West St., New York City.....Charter
WADE, OTIS, Bessey Hall, State Univ., Lincoln, Neb..... 1926
WADSWORTH, DR. SAMUEL F., Commonwealth Hospital for Animals, 26 Cummington St., Back Bay, Boston, Mass..... 1927
WAGNER, PROF. GEORGE, No. 68, Biology Building, Univ. of Wisconsin, Madison, Wis.....Charter
WAINWRIGHT, DR. J. M., Scranton, Pa..... 1927
*WALCOTT, F. C., Norfolk, Conn.....Charter
WALKER, ALEXANDER, Route A, Box 267, Tillamook, Oregon..... 1921
*WALKER, BRYANT, 1306 Dime Bank Bldg., Detroit, Mich..... 1924
WALKER, ERNEST P., 114 Maple Ave., Takoma Park, Md.....Charter
WALKER, GEORGE R., R. F. D. 3, Murray, Utah..... 1927
WALLER, MAJ. L. W. T., JR., E. I. du Pont de Nemours Co., Sporting Powder Div., Room 5056, Du Pont Bldg., Wilmington, Del..... 1929
WALTERS, LEON L., Field Museum of Natural History, Chicago, Ill....Charter
WANG, DR. GING H., Institute of Psychology, Sun Yat Sen Univ., Canton, China..... 1927
WARD, HENRY L., Kent Scientific Museum, Grand Rapids, Mich.....Charter
WARMBATH, JULIAN S., U. S. National Museum, Washington, D. C....Charter
WARREN, EDWARD R., 1511 Wood Avenue, Colorado Springs, Colo.....Charter
WARTHIN, ALDRED S., JR., N. E. Bldg., Vassar College, Poughkeepsie, N. Y..... 1926

WAY, IVAN M., 809 Harrison St., Denver, Colorado..... 1926
WEBER, CAROLYN H., 5019 N. Kildare Ave., Chicago, Ill..... 1930
WEBER, MRS. GRACE K., 5019 N. Kildare Ave., Chicago, Ill..... 1930
WEBER, LOUIS, 4740 Mascher St., Philadelphia, Pa..... 1927
WEBSTER, E. B., Port Angeles, Washington..... 1922
WEBSTER, FRANK E., Hyde Park, Mass.....Charter
WEED, PROF. LEWIS H., Department of Anatomy, Johns Hopkins Medical School, Baltimore, Md..... 1921
WEEKS, HAROLD M., 20 Little Farms Road, Larchmont, N. Y..... 1929
WEEMS, CARRINGTON, 23 Wall St., New York City..... 1930
WEGEFORTH, DR. HARRY M., 210 Maple St., San Diego, Calif..... 1923
*WEHRHANE, HENRY H., 888 Park Ave., New York City..... 1924
WEN, I-CHUAN, 1513 N. Broadway, Baltimore, Md..... 1928
*WETMORE, DR. ALEXANDER, U. S. National Museum, Washington, D. C.....Charter
WEYDEMEYER, WINTON W., Fortine, Mont..... 1927
WHELEN, MAJ. TOWNSEND, 3231 Garfield St., Washington, D. C..... 1924
WHITE, MISS BESSIE A., River View Hospital, Red Bank, N. J..... 1928
*WHITE, FRANCIS B., Saint Paul's School, Concord, N. H.....Charter
WHITE, JAMES S., 1114 Ardmore Ave., Chicago, Ill..... 1930
WHITE, THEODORE E., Museum of Zoology, Ann Arbor, Mich..... 1926
WHITEHEAD, L. C., 402 Aztec Bldg., San Antonio, Texas..... 1924
WHITLOW, WAYNE B., 1029 N. Quincy St., Topeka, Kansas..... 1929
WHITNEY, DR. ALVIN G., N. Y. State Museum, Albany, N. Y.....Charter
WIDMANN, OTTO, 5105 Enright Avenue, Saint Louis, Mo.....Charter
WIGHT, PROF. H. M., 1006 Granger Ave., Ann Arbor, Mich..... 1921
WILDER, H. E., Carlotta, Humboldt Co., Calif.....Charter
WILLIAMS, COLEMAN S., 35 W. 9th St., New York City..... 1930
WILLIAMS, ELMER, 515 P. O. Bldg., Portland, Ore..... 1930
WILLIAMS, MERTON Y., Univ. of British Columbia, Vancouver, B. C., Can.....Charter
WILLIAMS, OWEN L., 1228 Garfield St., Lincoln, Neb..... 1927
WILSON, MRS. BERYL M., Box 128, Davis, Calif..... 1930
WILSON, HAROLD C., Ephraim, Wis..... 1928
WINSON, J. W., Box 642, Sumas, Wash..... 1930
WINTON, PROF. W. M., Texas Christian Univ., Fort Worth, Texas..... 1922
WISLOCKI, DR. G. B., Dept. of Anatomy, Johns Hopkins Medical School, Baltimore, Md.....Charter
WITTLINGER, MISS BERTHA, Apt. 203, 512 W. 122 St., New York City.... 1926
WOLFE, CAPT. L. R., Fort Warren, Cheyenne, Wyo..... 1923
WOOD, ALBERT E., Cape May Court House, N. J..... 1928
WOOD, DR. CASEY A., 7 West Madison St., Chicago, Ill..... 1924
WOOD, DR. CLIFFORD H., Box 87, Glendora, Calif..... 1925
WOOD, PROF. HORACE ELMER, 2nd, Geology Dept., New York Univ., New York City..... 1924
WOODWARD, HARRY R., 205 Connor St., Hot Springs, S. Dak..... 1930
WOODWARD, DR. LEMUEL F., 52 Pearl St., Worcester, Mass..... 1923
WORDELL, HOWARD I., 334 Hawthorn St., New Bedford, Mass..... 1928

WRIGHT, DR. ALBERT H., Cornell Univ., Ithaca, N. Y.....Charter
WRIGHT, GEO. M., 405 American Trust Bldg., Berkeley, Calif..... 1928
WRIGHT, DR. SEWALL, Dept. Zool., Univ. of Chicago, Chicago, Ill.....Charter
WYMAN, DR. LELAND C., Dept. of Physiology, Boston Univ. School of Medicine, Boston, Mass.....Charter
WYTHE, MISS MARGARET W., Museum of Vertebrate Zoology, Berkeley, Calif.....Charter
YEAGER, DORR G., Yellowstone Park, Wyo..... 1930
YERKES, DR. ROBERT M., Kent Hall, Yale Univ., New Haven, Conn...Charter
YOUNG, CHARLES H., Victoria Memorial Museum, Ottawa, Ontario, Canada..... 1922
YOUNG, STANLEY P., U. S. Biological Survey, Washington, D. C..... 1928
ZIMMER, JOHN T., American Museum of Natural History, New York, N. Y..... .....Charter
Director, Zoological Service, Giza, Egypt..... 1926

TWELFTH ANNUAL MEETING OF THE AMERICAN SOCIETY OF MAMMALOGISTS

The twelfth annual meeting of the American Society of Mammalogists was held at the American Museum of Natural History, New York City from May 21 to 24, 1930, with 96 members in attendance. The program comprised 53 titles as follows:

PROGRAM

TUESDAY, MAY 20

8:00 p.m.

Meeting of the Board of Directors at the American Museum

WEDNESDAY, MAY 21

9:00 a.m.

1. Address of welcome by Henry Fairfield Osborn.
2. Response by Witmer Stone, President of the Society.
3. New conceptions of species, genera, and classification discovered in the evolution of the Titanotheres. Henry Fairfield Osborn.
4. The coyote—archpredator. E. A. Goldman.
5. The control of the coyote. W. C. Henderson.
6. Rational predatory animal control. C. C. Adams and A. G. Whitney.

1:30 p.m.

Annual business meeting of the Society

7. Predatory animal destruction. E. Raymond Hall.
8. Fur bearers caught in traps set for predatory animals. Joseph Dixon.
9. At the cross-roads. A. Brazier Howell.
10. Machines in fools' hands—a new world menace to wild life. Henry R. Carey.

11. The steel trap, a menace to conservation. Mrs. Edward Breck.
12. The present status of the musk-ox. R. M. Anderson.

THURSDAY, MAY 22

9:00 a.m.

Symposium on the gorilla, arranged by W. K. Gregory

13. Observations on young gorillas. J. H. McGregor.
14. Observations on the growth of a young gorilla. C. V. Noback.
15. The species or subspecies of *Gorilla*. H. J. Coolidge, Jr.
16. The skeleton of higher primates with special reference to *Gorilla*. A. H. Schultz.
17. The facial musculature of higher primates with special reference to *Gorilla*. Ernst Huber.
18. The female reproductive organs of higher primates with special reference to *Gorilla*. G. B. Wislocki.
19. Epiphyseal union in anthropoids and man. T. Wingate Todd.
20. Comparative psychology of gorillas. Harold C. Bingham.

1:30 p.m.

21. The gorilla pelvis. H. C. Waterman.
22. Activities of gorilla. H. C. Bingham.
23. The foot-musculature of higher primates with special reference to *Gorilla*. W. L. Straus, Jr.
24. The gorilla hand and foot. D. J. Morton.
25. Dermatoglyphics in primates with special reference to *Gorilla*. C. Midlo.
26. The dentition of *Australopithecus africanus*. R. A. Dart.
27. Discussion of Dr. Dart's paper with notes on the dentition of *Australopithecus* and of *Gorilla*. Milo Hellman.

7:00 p.m.

Annual dinner of the Society

followed by moving pictures of a comedy with chimpanzees as the actors, and remarkable views of Alaskan big brown bears, taken and explained by John M. Holzworth.

FRIDAY, MAY 23

9:00 a.m.

28. White-tailed deer—investigations and control. J. J. Slautterback.
29. (a) Animal life in the Grand Canyon, and (b) Bats in North American caves. Vernon Bailey.
30. Attrition in incisor teeth of rodents. A. R. Shadle.
31. Refutation of the alleged diametric growth of erupted rat molars. Horace Elmer Wood, 2d.
32. The occurrence of two subspecies of the same species in the same area. Lee R. Dice.
33. Proposed new classification of the families of mammals. G. G. Simpson.
34. The mammal fauna of China and Mongolia. Glover M. Allen.
35. Parturition of the monkey *Macacus rhesus* (read by title). Carl G. Hartman.

36. An experimental study of motivation in the white rat. C. J. Warden.
37. An experimental study on the intelligence of the cat. A. S. Firkins.

1:30 p.m.

38. Modern methods of disseminating knowledge concerning mammals. W. H. Cheesman.
39. Studies on the biology of introduced rats in San Francisco. Tracy I. Storer.
40. A study of the life history of the eastern chipmunk, *Tamias striatus lysteri* (Richardson). Elsa G. Allen.
41. Remarks on the genus *Marmosa*. G. H. H. Tate.
42. Results of a systematic study of American weasels. E. Raymond Hall.
43. On some Tertiary rodents from western North America. E. Raymond Hall.
44. The pelage, weight, and feeding habits of the raccoon. Leon F. Whitney.
45. Remarks on the fauna of Abyssinia. T. Donald Carter.
46. Collecting recent and fossil mammals in Yucatan. Robert T. Hatt.

4:30 p.m.

Final business meeting of the Society

8:15 p.m.

Motion pictures of African mammals. A private showing of selected films taken by Martin Johnson and by Herman Cron

SATURDAY, MAY 24

9:00 a.m.

Symposium on the utilization of zoological park collections for research, arranged by W. Reid Blair

47. Exhibition of rare mammals in the zoological park. C. W. Leister.
48. Reaction of anthropoid apes to training, and experiments in finger-printing among the primates. Raymond L. Ditmars.
49. The use of material from zoological gardens for the purposes of haematological research. Eric Ponder.
50. Direct bone formation in the tines of American wapiti. C. V. Noback.
51. Types of intestinal parasites found in a survey of mammals in the zoological park. G. W. McClure.
52. Problems that arise in the care of a captive young gorilla. C. V. Noback.
53. The domestic dog of Papua. Lee S. Crandall.

At the conclusion of the Saturday morning session the members were transported by automobile to the New York Zoological Park, where they were guests at luncheon of the New York Zoological Society. After luncheon officials of the Zoological Society conducted the members on a tour of the park.

With the exception of the Washington meeting of 1928 the present session had the largest attendance in the history of the Society, and was one of the most interesting. The increase in attendance by members residing at a distance is especially gratifying. Among these were Harold H. Bailey from Florida, and E. Raymond Hall, Tracy I. Storer, and Clark P. Streator from California, and Charles T. Vorhies from Arizona.

At the business meeting all of the officers proper of the Society were reelected

with one exception. Arthur J. Poole, who for ten years has been the faithful and tireless treasurer of the Society, requested that he be relieved from serving further in this capacity, and his resignation was accepted with great regret. The Society thereupon tendered Mr. Poole a vote of thanks in appreciation of his long and valued service to the organization. Mrs. Viola S. Snyder, of the Bureau of Biological Survey, was unanimously elected to the office of treasurer. Directors were elected as listed upon the cover of this issue of the Journal.

Members of the Society will learn with great pleasure that Clinton Hart Merriam and Edward William Nelson were unanimously elected to the class of honorary membership in token of their inestimable services to mammalogy.

A vote of thanks was tendered William P. Harris, Jr., for his energetic efforts during the past year as chairman of the Membership Committee. Efforts, during the past five years, to increase the membership of the Society to the one thousand mark have shown that under present conditions the Society is now about as large as it is practicable to make it. Not only is any substantial increment in its membership a disproportionately arduous as well as expensive undertaking, but much effort is necessary to maintain the roster at its present numerical status. It seems to the corresponding secretary that the effort thus expended could be utilized by the Society in some other direction to better advantage, even though some loss in membership might ensue.

The number of members delinquent in their current (1930) dues is almost twice as great as ever before. The collection of these dues, with attendant cancellation and subsequent reissuing of Journal subscriptions is one of the most onerous duties of both corresponding secretary and treasurer, and members will very materially lighten the burden now devolving upon these officers if they attend to this obligation as promptly as possible.

During the past year the Society has learned, with deep regret, of the death of the following of its members: A. B. Baker, H. J. Donaldson, V. A. Huard, E. Lester Jones, Alfred Marshall, and Oldfield Thomas.

A summary of the report of the corresponding secretary follows:

New members elected at the current meeting	103
New subscribers added since last meeting	19
Total gross additions to the mailing list of the JOURNAL	122
Life members added since last meeting	3
Number of honorary members	4
Number of life members	62
Number of annual members	939
Total present membership of the Society	1005
Members deceased since last meeting	6
Resignations since last meeting	34
Number of members delinquent 1930 dues	90
Number of members delinquent 1929 dues	33
Number of members delinquent 1928 dues	39
Dropped from membership for nonpayment of 1927 dues	32
Present mailing list of the JOURNAL	939

At its final business session the Society passed resolutions expressing its appreciation of the facilities and courtesies extended to it by President Henry Fair-

field Osborn of the American Museum, by President Madison Grant and the other officers of the New York Zoological Society, by Dr. W. Reid Blair, Director of the Zoological Park, and by Chairman H. E. Anthony and members, W. Reid Blair and Robert T. Hatt, of the local committee on arrangements.

In addition the Society adopted the following resolutions:

WHEREAS: The study of animal life is of great importance to mankind in many ways; and,

WHEREAS: It is desirable that such study be more fully enccuraged and facilitated by the Government of the United States as well as by schools and other institutions; therefore,

Be It Resolved: that the Congress of the United States is hereby petitioned to provide funds for the early erection of a suitable building for the study and exhibition of small mammals in the National Zoological Park, Washington, D. C.; and,

Be It Further Resolved: That the President of this Society is directed to appoint a committee whose duty it shall be to call this matter to the attention of the proper officers of the Government and of such other persons and organizations as may seem desirable; and,

Be It Further Resolved: That copies of this resolution be sent to the chairmen of the Senate and House District Committees, to the President of the Senate and the Speaker of the House; to the Secretary of the Smithsonian Institution; and to the Commissioners of the District of Columbia.

Resolved, that in accordance with the facts brought out in the discussion of the film "Ingagi", which has been viewed by many of our members, the American Society of Mammalogists hereby expresses its disapproval of this film, which grossly misrepresents the natural history of Africa while pretending to be a truthful record of a scientific expedition.

Be It Resolved: That the American Society of Mammalogists favors the establishment of a Wild Life Sanctuary or National Park in southern Florida for the express purpose of saving all mammals, birds, and other forms of wild animals and of native flora found therein; and,

Be It Resolved: That a copy of this resolution be sent to the President of the United States, to the members of Congress from Florida, and to such other state and federal officials as may be concerned in the proposed reservation or park.

WHEREAS: The natural habitats of the grizzly and brown bears of Alaska are now being claimed by civilization, which threatens their complete extermination; and,

WHEREAS: The islands of Admirality and Chichagof, located in Southeastern Alaska, are now populated by grizzly and brown bears of several species, and are ideally situated both by reasons of location, size, and physical topography to be permanent sanctuaries for these animals; therefore, be it

Resolved: That the proper governmental authorities be urged to set aside the said islands, Admirality and Chichagof, as inviolate sanctuaries for the Alaskan brown bear and grizzly bear in order that these two characteristic American animals may be protected and preserved.

WHEREAS: The Alaska Game Commission by amendments to the Alaska Game Law, which will become effective July 1, 1930, has removed all restrictions on the killing of grizzly and brown bears by residents, except in several comparatively small areas; and,

WHEREAS: The removal of these restrictions will endanger the existence of these species; and,

WHEREAS: The grizzly bear is fast becoming extinct in the United States and has been lessened greatly in numbers in Alaska in recent years by intensive hunting; therefore, be it

Resolved: That the American Society of Mammalogists deplores the action of the Alaska Game Commission in removing restrictions on the killing of grizzly and brown bears by residents of Alaska; and, be it further

Resolved: That copies of this resolution be sent to the Members of Congress and the Senate; to the Chief of the United States Biological Survey; and to the Alaska Game Commission, urging that steps be promptly taken to the end that the protection now accorded these animals be continued.

WHEREAS: The American Society of Mammalogists, a group of over 1000 naturalists, is vitally concerned with the welfare and preservation of all kinds of wild mammals; and,

WHEREAS: We heartily approve the stated policy of the Bureau of Biological Survey of the United States Department of Agriculture not to carry control measures to the point of extermination, and hope that field practice will conform strictly to this policy; and,

WHEREAS: Nevertheless, many valuable mammals have been destroyed by the methods of control now being used by the Biological Survey and coöperating agencies; therefore, be it

Resolved: That campaigns for the destruction of predatory mammals should be conducted only in those localities where scientific study has shown that such control measures are necessary for the general public welfare and are not solely for the benefit of some special interest; and, be it

Resolved: That the use of poison for the control of predatory mammals should be abandoned, except in cases of absolute necessity, such as might arise during an outbreak of rabies in coyotes.

It was moved, seconded, and carried that a committee to consist of H. E. Anthony (Chairman), Lee R. Dice, M. P. Skinner, Tracy I. Storer, and Charles T. Vorhies be appointed to see that the terms of this resolution be carried out and to coöperate with all responsible agencies, Federal and State, concerned.

COMMENT AND NEWS

A FURTHER NOTE ON AQUATIC MAMMALS

Since my recently published (1930) report on adaptations of aquatic mammals went to press there has come to hand information that renders it advisable for me to qualify two of my original statements. In regard to the water opossum (*Chironectes*) the assertion was made that the tail is round, this having been based upon information furnished by an individual who had observed the animal in the flesh, and from the examination of dried study skins. I expressed some surprise that a mammal with feet so well modified for swimming should still have a terete tail and advanced the opinion that it should show indications of flattening before long, but was unable to predict whether this would be in the horizontal or the vertical plane. G. H. H. Tate has recently informed me that the tail of this animal is *not* perfectly round, and showed me a skin which he had carefully made so as to indicate that this member is triangular in cross section. But it is thus still impossible to predict the plane of final flattening.

I have been considerably puzzled by encountering in cetacean literature the statement that the tongue of rorquals is of enormous size. I thought that this must refer to the absolute rather than relative proportions, for in every case the tongue of the many finbacks which I have seen has been relatively of surprisingly small size, occupying an insignificant space within the oral cavity. Consequently I was somewhat astonished recently to see in a clear photograph (Townsend, Twentieth Century Whaling, Bull. N. Y. Zool. Soc., vol. 33, 1930, p. 26) an enormous mass of lingual tissue protruding from the mouth and well beyond the rostrum of a dead rorqual (either blue whale or finback). Unquestionably the lingual musculature of the rorquals which I observed was decadent and practically non-functional, and I am still convinced that its rôle in the economy of the animal is that which I stated. These particular whales, however, were not very fat and it occurs to me that the tongue, exceedingly oily even in a thin rorqual, may really act as a reservoir for the storage of fat, thus varying greatly in size according to the condition of the animal. Such a possibility can not be entertained in the case of the balaenid whales, however, for their tongue is essentially muscular, according to accounts, rather than fatty.—A. Brazier Howell, *Department of Anatomy, Johns Hopkins Medical School, Baltimore, Md.*

FUR FARMING AND GAME RAISING, OLD IDEAS

We are wont to think of fur farming and game raising as strictly modern ideas, and successful operations in these fields are, of course, the result of comparatively recent experiments and developments. It is of interest to note, however, that nearly a century ago it was suggested that certain species of fur-bearing mammals might be raised for their pelts, and that elk and deer would be domesticated. The report in question is so rare in libraries and so interesting at this time that it is worth quoting, in part, exactly as it was written by Jared P. Kirtland (First Annual Report of the Geol. Surv. of Ohio, no. 3, p. 67, 1838):

"There are, doubtless, many species belonging to both these kingdoms that possess useful properties, that are now neglected, and are rapidly disappearing before the progress of cultivation and improvement. Most of the larger mam-

malia have already become extinct in Ohio. Forty years since, the Bison (*Bos Americanus*) visited our borders; at this time, few or no Elk (*Cervus Canadensis*) remain, and the common Deer (*Cervus Virginianus*) are comparatively rare. Not withstanding they all have once existed in great abundance on our frontiers, it yet remains to be decided by experiment, whether they might not be domesticated, so as to become serviceable as beasts of burthen or as articles of food.

"All of our domestic animals were originally as wild, and perhaps as unpromising in their habits as either of these; yet, by a long course of training, and by familiarity with man, have entirely changed their dispositions. We have no evidence, so far as I am informed, to show that the Bison might not be successfully taught to yield its neck to the yoke as well as the Ox. It is said, that in some parts of the East Indies, the Buffalo (*Bos bubalus*), which is analogous to our Bison, is employed for carrying burthens and for draughts.

"The Elk and Deer will, without doubt, be domesticated, as objects of curiosity, if not of profit, as our State advances in improvements and luxury.

"There is another family of animals that deserves more attention; I allude to the *fur bearing*, including the Beaver, (*Castor Fiber*,) Otter, (*Lutra Brasiliensis*,) and Musk-rat, (*Fiber Zibeticus*). The sources from whence the supplies of fur are derived, are principally the northern parts of Russia and northern and western parts of America. The energy with which the Fur Trade has been carried on, for the last thirty years, has rapidly exhausted these sources, particularly the latter; and it is said by those experienced in the business, that they will fall far short of satisfying the increasing demand before the end of twenty years. It therefore becomes an object of worthy of enquiry whether some or all of those kinds of animals might not be profitably domesticated for their peltries.

"From my own experience, I know that both the Beaver and the Otter will, with a little attention, become as docile and as obedient to the commands of man as most of our *household* animals; and I am convinced that, in localities where abundant supplies of suitable food are found, as great profits might be realized by breeding them as are anticipated from the productions of the Silk-worm in this country."—HARTLEY H. T. JACKSON, *U. S. Biological Survey, Washington, D. C.*

MAMMAL AND BIRD SURVEY OF IDAHO

Members of the American Society of Mammalogists may be interested to know that Mr. Ralph Ellis, Jr., of Berkeley, California, and Jericho, Long Island, New York, is undertaking a survey of the bird and mammal life of the state of Idaho. Field work beginning May 15 of this year is planned to extend over a period of at least five years. Reports on completed sections may be published from time to time.

Mr. Adrey E. Borell, assisted by Mr. Raymond M. Gilmore, both graduates of the University of California, will participate in this summer's field work. They plan to begin at Weiser and work northward through the Seven Devils Mountains in the west-central part of the state.

Mr. Ellis and Mr. Borell have recently carried out a survey of the birds and mammals of Ruby Mountains, Elko County, Nevada. A report on the mammals of this region is now being prepared.

Idaho has been chosen because its bird and mammal fauna is comparatively little known and because work there links up readily with the work already done in north-eastern Nevada.

To the Members of the American Society of Mammalogists:

Anyone engaged in research welcomes contact with fellow workers. Keeping in touch with others in the same field facilitates an exchange of ideas of value to all, in regard to technique, view point, or general approach to the problem. With these considerations in mind the Committee on Life Histories and Ecology urges anyone who is interested in these subjects to communicate with the committee, addressing the chairman at Jackson, Wyoming, stating in what particular field he is interested and where he is carrying on investigations. With such facts at hand, the committee will be in a position to furnish desired information to those seeking it. We urge you to use your committee in this way. Give us any suggestions you may have, and by whole hearted cooperation benefit will accrue to us all.

COMMITTEE ON LIFE HISTORIES AND ECOLOGY,
R. K. ENDERS
C. E. JOHNSON
L. M. HUEY
ADOLPH MURIE
O. J. MURIE, *Chairman*

It is a pleasure to repeat the words of Frank Collins Baker in Science, July 11, 1930, page 39:

Taxonomy is but a tool which is used for the interpretation of life processes, and yet its value is beyond question and can not be denied by any one. It is the foundation upon which all the biological sciences rest. The alleged overmultiplication of generic and varietal names is but an attempt to inquire more closely into the true relationships of organisms. More attention should be given to this subject in university curricula in order that the student may have a just appreciation of its importance and an understanding and sympathetic attitude toward the systematist who is endeavoring to make a just and true interpretation of the relation of life to the laws through which it has come into existence.

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A. Brazier Howell, ***Corresponding Secretary***

Department of Anatomy, Johns Hopkins Medical School, Baltimore, Md.

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